CEEW
THE COUNCIL

Rethinking Ocean Governance in an Era of Climate Urgency

Science, Impact and the Complexities in Between

Nandini Harihar and Ankur Malyan

Report | January 2024

Suggested citation: Harihar, Nandini and Ankur Malyan. 2024. *Rethinking Ocean Governance in an Era of Cimate Urgency: Science, Impact and the Complexities in Between.* New Delhi: Council on Energy, Environment and Water.

Disclaimer: The views expressed in this study are that of the authors. They do not necessarily reflect the views and policies of the Council on Energy, Environment and Water.

Cover image: iStock.

Peer reviewers: Michael Conathan, Senior Policy Fellow on Ocean and Climate, Energy and Environment Program, The Aspen Institute, USA; Swati Ganeshan, Shakti RISE (Research Innovation Shakti Expert) Fellow, India; and Vishwas Chitale, Senior Programme Lead, CEEW.

Acknowledgment: We would like to thank our reviewers for their comment and suggestions which helped a lot in bringing the report to current form. We also extend our gratitude to Dr Arunabha Ghosh, CEO, CEEW, for guiding us from the inception of the concept to the completion of the study. Dr Ghosh's guidance has provided us with the direction which helped enormously in shaping this study. Additionally, we would like to our colleagues at CEEW to provide their valuable comments on the work which helped us improve significantly.

Publication team: Kartikeya Jain (CEEW); Alina Sen (CEEW); The Clean Copy; Twig Designs; and FRIENDS Digital Colour Solutions.

Organisation: The **Council on Energy, Environment and Water** (CEEW) is one of Asia's leading not-for-profit policy research institutions and among the world's top climate think tanks. The Council uses data, integrated analysis, and strategic outreach to explain — and change — the use, reuse, and misuse of resources. The Council addresses pressing global challenges through an integrated and internationally focused approach. It prides itself on the independence of its high-quality research, develops partnerships with public and private institutions, and engages with the wider public. CEEW has a footprint in over 20 Indian states and has repeatedly featured among the world's best managed and independent think tanks.
Follow us on X (formerly Twitter) @CEEWIndia for the latest updates.

Council on Energy, Environment and Water
ISID Campus, 4 Vasant Kunj Institutional Area
New Delhi – 110070, India
+91 11 4073 3300

info@ceew.in | ceew.in | @CEEWIndia | ceewindia

CEEW
THE COUNCIL

Rethinking Ocean Governance in an Era of Climate Urgency

Science, Impact and the Complexities in Between

Nandini Harihar and Ankur Malyan

Report
January 2024
ceew.in

About CEEW

The Council on Energy, Environment and Water (CEEW) is one of Asia's leading not-for-profit policy research institutions and among the world's top climate think tanks. **The Council uses data, integrated analysis, and strategic outreach to explain — and change — the use, reuse, and misuse of resources.** The Council addresses pressing global challenges through an integrated and internationally focused approach. It prides itself on the independence of its high-quality research, develops partnerships with public and private institutions, and engages with the wider public. CEEW is a strategic/ knowledge partner to 11 ministries for India's G20 presidency.

The Council's illustrious Board comprises Mr Jamshyd Godrej (Chairperson), Dr Anil Kakodkar, Mr S. Ramadorai, Mr Montek Singh Ahluwalia, Dr Naushad Forbes, and Dr Janmejaya Sinha. The 250-strong executive team is led by Dr Arunabha Ghosh. **CEEW was certified a Great Place To Work® in 2020 and 2021.** It has also repeatedly featured among the world's best managed and independent think tanks.

In over 13 years of operations, The Council has engaged in over 450 research projects, published 380+ peer-reviewed books, policy reports and papers, created 190+ databases or improved access to data, advised governments around the world 1400+ times, promoted bilateral and multilateral initiatives on 130+ occasions, and organised 540 seminars and conferences. In July 2019, Minister Dharmendra Pradhan and Dr Fatih Birol (IEA) launched the CEEW Centre for Energy Finance. In August 2020, Powering Livelihoods — a CEEW and Villgro initiative for rural start-ups — was launched by Minister Piyush Goyal, Dr Rajiv Kumar (then NITI Aayog), and H.E. Ms Damilola Ogunbiyi (SEforAll).

The Council's major contributions include: Informing India's net-zero goals; work for the PMO on accelerated targets for renewables, power sector reforms, environmental clearances, *Swachh Bharat*; pathbreaking work for India's G20 presidency, the Paris Agreement, the HFC deal, the aviation emissions agreement, and international climate technology cooperation; the first independent evaluation of the *National Solar Mission*; India's first report on global governance, submitted to the National Security Advisor; support to the National Green Hydrogen and Green Steel Missions; the 584-page *National Water Resources Framework Study* for India's 12th Five Year Plan; irrigation reform for Bihar; the birth of the Clean Energy Access Network; the concept and strategy for the International Solar Alliance (ISA); the Common Risk Mitigation Mechanism (CRMM); India's largest multidimensional energy access survey (ACCESS); critical minerals for *Make in India*; India's climate geoengineering governance; analysing energy transition in emerging economies, including Indonesia, South Africa, Sri Lanka, and Viet Nam. CEEW published *Jobs, Growth and Sustainability: A New Social Contract for India's Recovery*, the first economic recovery report by a think tank during the COVID-19 pandemic.

The Council's current initiatives include: State-level modelling for energy and climate policies; consumer-centric smart metering transition and wholesale power market reforms; modelling carbon markets; piloting business models for solar rooftop adoption; fleet electrification and developing low-emission zones across cities; assessing green jobs potential at the state-level, circular economy of solar supply chains and wastewater; assessing carbon pricing mechanisms and India's carbon capture, usage and storage (CCUS) potential; developing a first-of-its-kind Climate Risk Atlas for India; sustainable cooling solutions; developing state-specific dairy sector roadmaps; supporting India's electric vehicle and battery ambitions; and enhancing global action for clean air via a global commission 'Our Common Air'.

The Council has a footprint in over 20 Indian states, working extensively with 15 state governments and grassroots NGOs. Some of these engagements include supporting power sector reforms in Uttar Pradesh, Rajasthan, and Haryana; energy policy in Rajasthan, Jharkhand, and Uttarakhand; driving low-carbon transitions in Bihar, Maharashtra, and Tamil Nadu; promoting sustainable livelihoods in Odisha, Bihar, and Uttar Pradesh; advancing industrial sustainability in Tamil Nadu, Uttar Pradesh, and Gujarat; evaluating community-based natural farming in Andhra Pradesh; and supporting groundwater management, e-auto adoption and examining crop residue burning in Punjab.

Contents

Corals cover 0.1% of the ocean but support 25% of marine species, provide livelihood opportunities to 500 million people globally, and contribute ~USD 1 trillion to the global economy.

Image: iStock

Executive summary

The ocean is the largest carbon sink in the world with a capacity of 38,100 GtC – 16 times greater than soil and vegetation (2,410 GtC) and 50 times more than the atmosphere (760 GtC) (Sallée 2018). It also drives fundamental geoscience mechanisms critical for the survival of life on Earth. This includes absorbing over 90 per cent of the additional heat generated due to greenhouse gases, producing over half the world's oxygen, and redistributing heat across the globe to regulate climate and weather patterns. The ocean provides income and employment to millions and fulfils the nutritional needs of nearly three billion people globally. The marine fisheries sector supports 200 million livelihoods – equal to the combined population of France, Germany, and Spain (as of 2023). By 2030, it is estimated that the global value added by the ocean economy will peak at USD 3 trillion, providing 40 million full-time equivalent jobs (OECD 2016). However, the overall ocean asset value (natural capital) is far greater, amounting to USD 24 trillion (Commonwealth Secretariat 2022; ADB 2021).

Nevertheless, these global benefits of the ocean are mired with challenges, such as climate change, ocean warming, sea-level rise, ocean acidification, and ineffective management of resources. These challenges alter marine productivity and ecosystem services, constrain the availability of resources, limit economic growth and development opportunities, and adversely impact the lives, livelihoods, and sustenance of dependent communities. Rising sea surface temperature (SST) due to climate change will likely alter global wind and weather patterns, affecting food and water security. For instance, in the past two decades, the frequency of tropical cyclones in the Arabian Sea has increased in comparison to the Bay of Bengal. Similarly, land inundation due to sea-level rise and climate migration is already a reality in some low-lying island states. Furthermore, the dual impact of climate change and ineffective fisheries management will likely decrease catch potential globally by 2050 (FAO 2018c). This will have severe consequences for jobs in developing countries, which account for 97 per cent of the world's fisher workforce, economic growth in countries where the fisheries sector contributes significantly to the national GDP, and sustenance of coastal communities by adversely affecting livelihood opportunities and food security. Finally, the lack of blue finance is a critical concern. Even though a third of all Sustainable Development Goal (SDG) targets depend on ocean sustainability, SDG 14 is one of the least funded by official development assistance (ODA) providers (Singh et al. 2018; OECD 2020).

A. Regime complex – the catalyst for global ocean governance

Despite our critical dependence on the ocean and its resources, the overall governance of the ocean is limited. Like climate change, energy security, and trade, the challenges of the ocean go beyond national borders. The transboundary nature of the ocean and the involvement of several stakeholders complicate the effective governance and management of this shared resource pool. The inherent diversity of interests leads to a regime complex, which challenges the development of comprehensive regulatory systems (Folami 2017; Keohane and Victor 2010). The current ocean governance structure is loosely linked, resulting in overlapping interests amongst diverse stakeholders. The ongoing challenge is to overcome this fragmented landscape of ocean governance, which is long-term and cannot be solved by a single nation. This is the crucial catalyst for discussing global ocean governance.

Ocean governance must be designed and implemented in an integrated manner involving all relevant stakeholders to enhance biodiversity protection, build the adaptive capacity of marine ecosystems and coastal communities, improve ocean stewardship and management of its resources, drive overall societal development, and shield vulnerable communities from climate change impacts. As of November 2021, only 54 NDC submissions from coastal states include at least one ocean-based action (Carbon Market Institute 2021). These must go beyond announcements to deliver action. In this regard, it is critical to explore the ocean's existing institutional and governance landscape to identify gaps and loopholes rather than create additional institutions that carry forward legacy issues in management.

> **Climate change will adversely effect productivity of fisheries, impacting job opportunities and economic growth in developing countries and livelihood sustenance of coastal communities.**

This report explores three research questions:

- What is the effect of anthropogenic emissions on ocean warming, ocean acidification, and ocean carbon storage capacity?
- How does climate change impact the jobs, growth, and sustenance of coastal communities and blue economy sectors, such as marine fisheries?
- What are the challenges in the current landscape of ocean governance? What can be done to address some of these challenges?

B. Key results and findings

The study analyses 62 global and regional agreements and conventions to highlight three aspects of regime complex in ocean governance: a) regulatory, b) regional, and c) issue-based.

Global and regional agreements and conventions are skewed in their focus and coverage

Figure ES1 illustrates the regulatory aspect of ocean governance. The horizontal axis represents functionality, i.e., the regulatory nature of marine agreements and conventions (legally binding or non-binding). The vertical axis highlights the spatial dimension, where 'centralised' implies governance in international waters, and 'decentralised' means focusing on a specific sea or ocean. The analysis highlights that 13 out of 62 agreements and conventions are centralised, with nearly 70 per cent established in a decentralised manner. Furthermore, 46 out of 62 marine agreements and conventions are decentralised and legally binding. Nearly 84 per cent of all agreements and conventions are legally binding, while centralised and non-binding account for a little less than 10 per cent of the portfolio. Given that 64 per cent of the ocean's surface lies in marine areas beyond national jurisdictions (ABNJ) – commonly referred to as the high seas or international waters – regional (decentralised) agreements are insufficient. Centralised agreements such as UNCLOS, MARPOL, PSMA, and CLC are critical to laying the governance framework on the high seas on which regional and national policies can build.

> Fragmented ocean governance results in uncoordinated action, limited monitoring and enforcement, and over exploitation of marine resources.

Secondly, marine issues receive varying attention regionally, depending on the ocean basin, the surrounding nations, and the strength of their economies. In the Atlantic Ocean, most agreements and conventions focus on marine protected areas (MPAs) and biodiversity protection, fisheries, and the conservation and protection of marine species. Fewer agreements and conventions govern the Indian Ocean with emphasis on integrated ecosystem-based management (EBM), sustainable development and management, MPAs and biodiversity protection, and effluent discharge (Figure ES2).

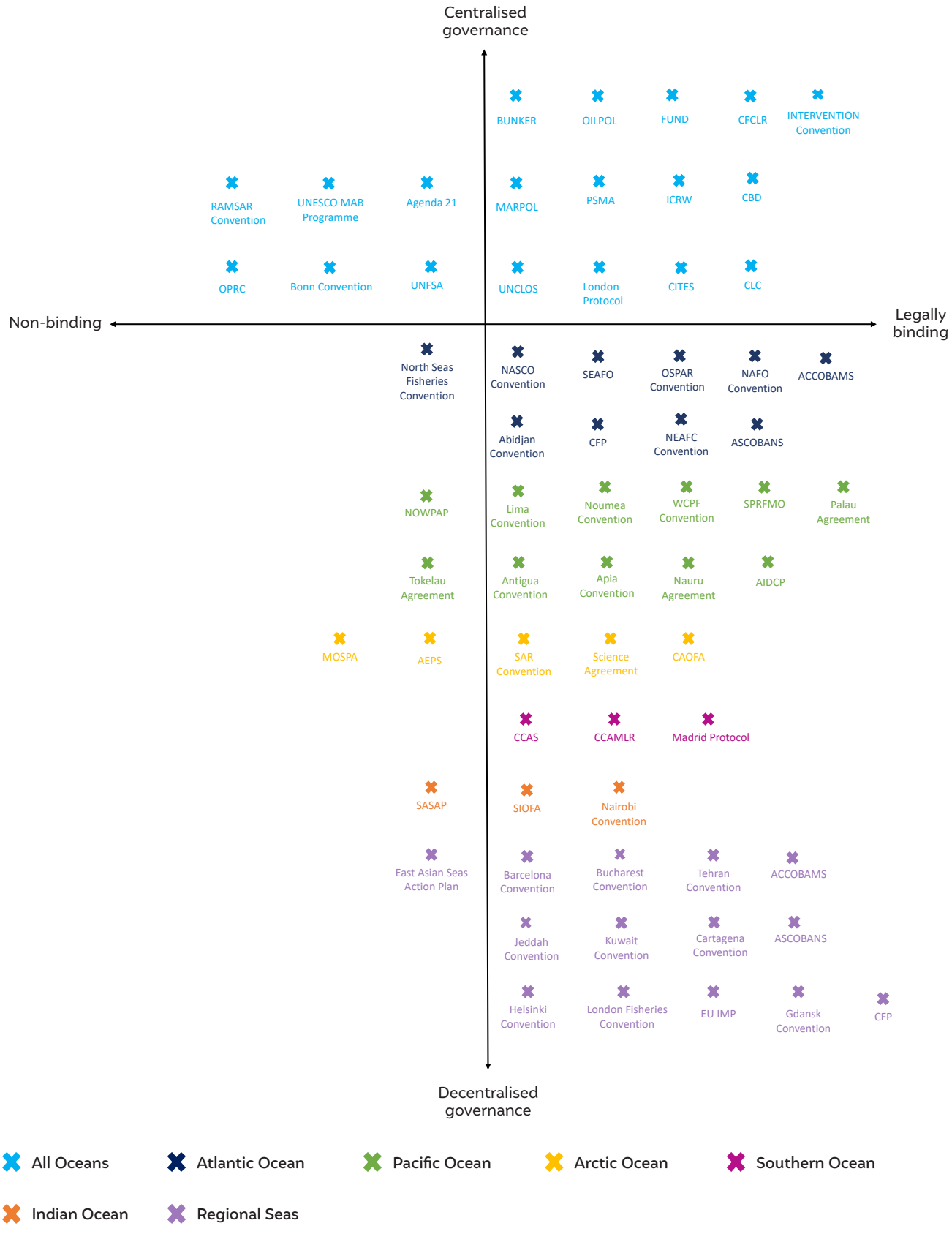
Thirdly, from an issue-based perspective, most marine agreements and conventions focus on MPAs and biodiversity protection (56 per cent), fisheries management (42 per cent), and integrated EBM (41 per cent). In contrast, issues such as marine geoengineering and reduction in greenhouse gas emissions receive little attention, with only a few regulations under the Convention on Biological Diversity and London Convention/London Protocol and MARPOL, respectively.

This inherent regime complex in ocean governance has resulted in unplanned and uncoordinated action towards ocean resource management, overexploitation of marine resources, lack of compliance, poor implementation, limited monitoring and enforcement, and unclear ownership of and responsibility for the high seas.

Effective institutional collaboration can address some complexities in the governance of the high seas

We evaluate 45 marine institutions (international, regional, and intergovernmental and UN organisations; academia and scientific institutions; private-sector and civil society organisations) (Annexure 3) to highlight the overlaps across different functionalities. These include scientific research, policy research, conservation, management and regulation, advocacy, and knowledge mobilisation and building business strategies and partnerships.

Figure ES1 The regulatory landscape of ocean governance



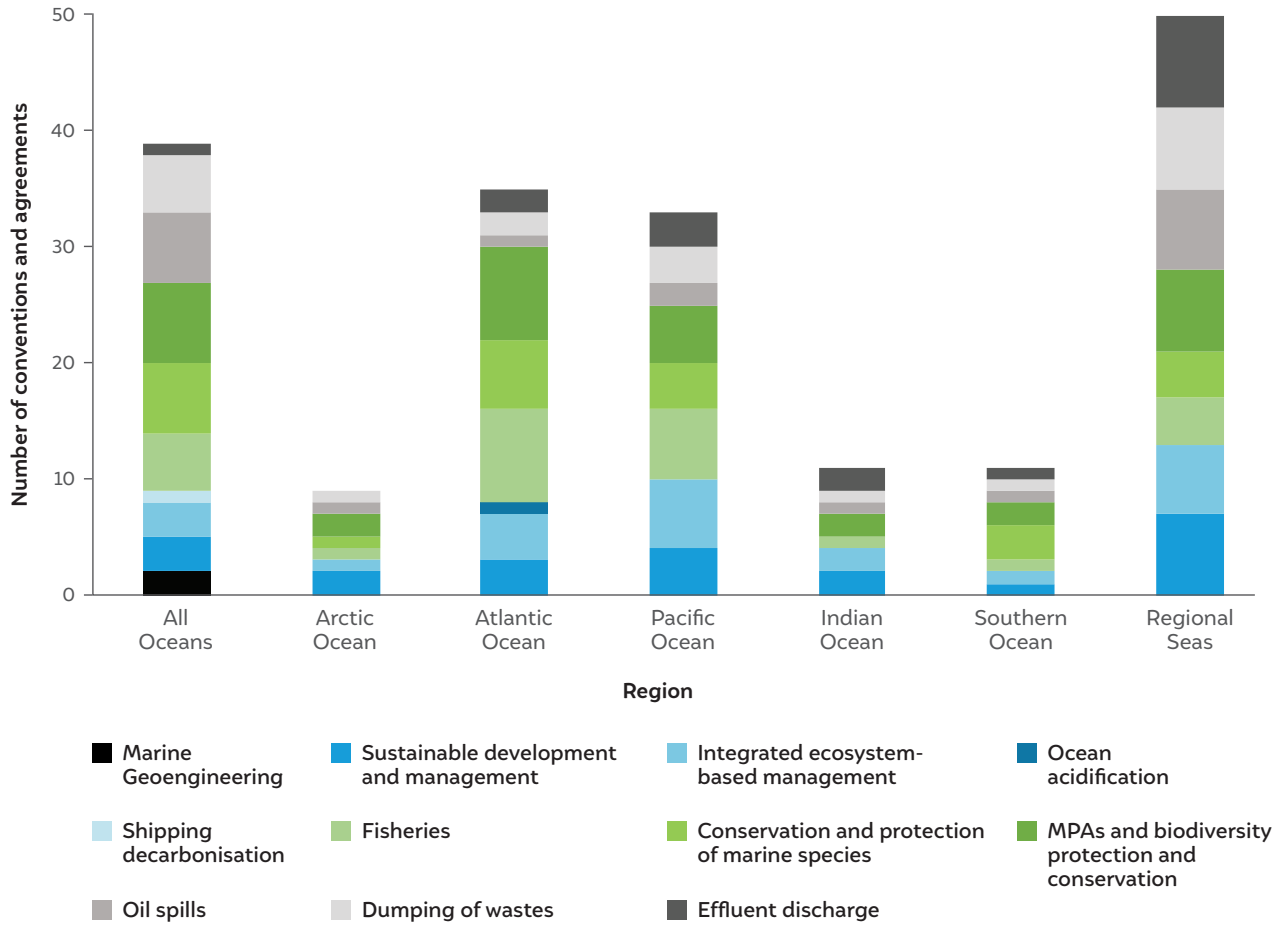
Source: Authors' analysis

The analysis highlights that nearly 59 per cent of these institutions are involved in conservation, management, and regulatory functions; 48 per cent work in scientific research; and 45 per cent work in knowledge mobilisation and building business strategies and partnerships (Figure 4).

Nearly a fourth of these institutions focus only on a specific function, while 39 per cent and 30 per cent are bi-functional and tri-functional respectively (Annexure 3). We also find that out of 45 institutions, 14 focus on policy research. Of this, only five institutions – Environmental Defense Fund (EDF), Food and Agriculture Organization (FAO), International Union of Conservation of Nature (IUCN), Natural Resources Defense Council (NRDC), and United Nations Environmental Programme (UNEP) – work parallelly on scientific analysis alongside policy to bridge the science-policy interface gap; this is critical to developing evidence-based solutions.

The study finds that the design and cross-functioning of institutions are critical in addressing complexities in managing the marine environment. For instance, the management approach of the CCAMLR' set a precedent for more MPAs to be developed in international waters. Secondly, in 2020, the NEAFC adopted new conservation and management measures for fish stocks based on scientific advice and in collaboration with the International Council for the Exploration of the Sea (ICES) (NEAFC 2020). Finally, the co-adoption of the Collective Arrangement by OSPAR and NEAFC helped manage human activities in the ABNJ. Hence, coherence and coordination across institutions, conventions, and commissions is critical to break out of silos, address varying marine challenges, and drive more collaborative efforts towards the sustainable management of the ocean and its resources.

Figure ES2 Regional issue-based classification of ocean agreements and conventions



Source: Authors' analysis

C. Recommendations and ways forward

While collaborative efforts sound rational, achieving them on a global or even regional scale in the ocean is difficult due to the regime complex of this shared resource pool. We propose the following recommendations to improve ocean governance:

1. **Promote inter-regional and legally binding conventions to improve coordination, collaboration, and compliance for sustainable management of the ocean**. The study highlights that inter-regional coordination and collaboration are essential to exchange knowledge on challenges and best practices and for the development and implementation of financial mechanisms. Non-binding agreements among states foster greater flexibility in management plans, willingness to participate (as noticed with the Paris Agreement), and effectiveness in dealing with uncertainty and urgent issues. However, when it comes to ensuring compliance and enforcement, legally binding conventions have fared better in inciting political commitments, establishing firmer institutions and financial foundations, outlining clearer pathways and mandates for action over time, and ensuring greater regulatory checks and balances. Thus, we propose that marine agreements and conventions could start as non-binding voluntary agreements (such as SASAP and NOWAP), which provide some form of agreement-based national and regional legislation around marine management by countries and regions lacking initial technical and financial capacity and political will. Once these voluntary agreements are in place, a legally binding convention can be established over time to encourage greater regional cooperation, compliance, and enforcement for management beyond the exclusive economic zones (EEZs) based on national circumstances.

2. **Enhance marine biodiversity protection by re-defining MPAs and their purposes and building cross-sectoral partnerships across the entire ecosystem**. To date, only 8.16 per cent of the ocean is protected, of which only 2.4 per cent is fully/highly protected from fishing impacts, and a mere 0.5 per cent of the ABNJ is off-limits for industrial exploitation (Marine Conservation Institute 2022; Heffernan 2018). Despite being protected, these regions allow the use of destructive fishing gear, resulting in the large-scale destruction of marine ecosystems. Hence, global MPAs and their purposes need to be re-defined to ban such practices in protected regions. Secondly, cross-sectoral partnerships (such as OSPAR and NEAFC) can improve the monitoring and exchange of learning and formulate synergies across various domains (environment, biodiversity, and fisheries) for holistic management of MPAs.

> **Every dollar invested in a sustainable ocean economy will yield USD 5 in return, resulting in a rate of return of 450–615% between 2020 and 2050.**

3. **Establish a G20 Fisheries Focus Group to promote sustainable fishing practices for a sustainable blue economy**. Since 1950, nearly six billion tonnes of fish and other marine invertebrates have been extracted, making the fishing industry a significant threat to marine wildlife (WWF, 2018). Additionally, six of the top ten fishing countries are part of the G20. The G20 should establish a Fisheries Focus Group to understand, assess, and evaluate sustainable fishing practices and technological improvements in fishing gear. Collective efforts towards small-scale fisheries can bring social, economic, and environmental benefits, ranging from the protection of marine fauna, generation of employment, and minimisation of loss from discarded by-catch. These efforts will go hand in hand with building a sustainable blue economy.

4. **Improve ocean data to enhance monitoring, evaluation, and decision-making processes for sustainable ocean management**: Robust policies for sustainable ocean management and governance requires reliable data and scientific insights on the ocean's social, environmental, and economic value, its contribution to society, and the impact of human activities on the marine environment. Developing a global ocean data inventory through regional collaboration would reduce the financial burden, improve regional security, manage and disseminate up-to-date data (a challenge observed with SASAP), and enhance knowledge exchange to improve the monitoring and evaluation of national and regional action plans (such as the PNA) to assist with evidence-based decision-making.

5. **Embed institutional resilience into the broader governance architecture of the ocean.** Coherence and coordination among institutions are critical for addressing challenges in the marine environment (UNDP 2017; UNGA 2017). First, overlapping institutions must define clear operational boundaries and mandates for effective institutional coherence (such as WCPFC with RFMOs). Secondly, regional partnerships are crucial to go beyond the controls of organisations. Such partnerships could either involve collaborations among convention commissions that partially overlap to bridge the gaps between the two (such as WCPFC and IATTC) or are based on similar issues involving different regulatory mandates (such as OSPAR and NEAFC). Thirdly, there is a need for greater synergy and coordination between conventions and associated organisations to align priorities and objectives and drive effective national-level action (such as NEAFC and IOTC with the PSMA). The learnings from such collaborations must be shared inter-regionally and with other institutions for effective management of the ABNJ.

The biggest wave to surf is the lack of political will and commitment towards ocean action; without finance, commitments cannot be delivered. A critical outcome of COP29 must be to procure blue finance at scale for SDG 14. For this, new avenues of blue financing need to be explored, and the narrow focus of climate finance must incorporate blue economy-related risks. Investing in the recovery and protection of the ocean ecosystems and better valuing and managing its resources can rebuild the ocean's resilience and that of communities dependent on it.

Finally, establishing the pace of transition is critical to address climate and ocean action holistically. Success stories from CCAMLR, Helsinki Convention, Nauru Agreement, OSPAR Convention, and WCPFC and RFMOs capture the essence of national, regional, and global cooperation, data sharing and management, institution building, and the science-policy interface between marine economic sectors and industries. With the UN Decade of Ocean Science for Sustainable Development or the 'Ocean Decade', we hope that actions to build a sustainable ocean economy will accelerate in the coming decade.

1. Introduction

The ocean enables fundamental geoscience mechanisms critical for the survival of life on Earth. These include producing over half of the world's oxygen, absorbing nearly 50 times more carbon dioxide (CO_2) than the atmosphere, storing over half of the global carbon reserves in the deep ocean, and redistributing heat across the globe to regulate the climate and weather patterns, among others (Fleming, 2019; Bates 2019; Bigg et al. 2003). Over the last century, increasing global emissions have altered the ocean's temperature, chemistry, and biogeochemical cycles, resulting in irreversible damages to marine and coastal biodiversity and communities (Allsopp et al. 2009). Furthermore, rising sea surface temperature (SST) is likely to alter global weather patterns, resulting in greater occurrences of cyclones (as observed in the Arabian Sea), heavy rainfall, and droughts, severely affecting agricultural productivity, food and water security, marine biodiversity, and the livelihoods of billions globally (IPCC 2013). Other challenges, such as climate change, ocean warming, sea-level rise, and ocean acidification, are also detrimental to marine productivity, ecosystem services, lives, and livelihoods.

The ocean is also mired by several governance challenges, making it difficult to manage this shared resource pool. The area beyond national jurisdictions (ABNJ) – i.e., the high seas or international waters – is described by the United Nations Convention on the Law of the Sea (UNCLOS) as a shared resource used by everyone and considered "no one's responsibility" since most of the ocean falls under no national jurisdiction (CBD et al. 2013). While various laws and treaties ensure peaceful, cooperative, and legally permissible use of the seas and the ocean, these efforts have so far been insufficient and fragmented.

In 1994, when the UNCLOS came into force, it solved various issues related to the sovereignty and utilisation of ocean resources by setting national territorial boundaries of 12 nautical miles offshore and exclusive economic zones (EEZ) up to 200 nautical miles offshore for countries to use for commercial activities (United Nations 2019a). While the convention resolved some issues, it also led to negligence in managing the ABNJ,

which accounts for 40 per cent of the planet's surface, 64 per cent of the ocean's surface, and 95 per cent of its volume (GEF 2019). While UNCLOS sets out obligations for states to cooperate in the conservation, preservation, and protection of the ABNJ, no legal authority is responsible for its ecological, economic, and political management and governance. This has resulted in the misuse and negligence of this shared resource pool, leading to overfishing, hazardous resource extraction, and destruction and pollution of marine biodiversity and habitats, adversely affecting coastal cities, communities, livelihoods, and national GDPs.

In 2015, the 21st Conference of Parties (COP21) launched a first-of-its-kind initiative – *Because the Ocean* – that suggested the need for an Ocean Action Plan within the United Nations Framework Convention on Climate Change (UNFCCC) for the implementation of SDG 14 (Life below Water). Since then, the initiative has committed to incorporating several ocean-based mitigation and adaptation measures into future nationally determined contributions (NDCs) under the Paris Agreement (Because the Ocean 2023). In 2019, the Intergovernmental Panel on Climate Change (IPCC) produced a standalone report – *Special Report on the Ocean and Cryosphere in a Changing Climate (SROCC)* – on the impact of climate change on the ocean, coastal biodiversity, and local communities. The report provided alarming evidence and projections regarding the adverse effects of accelerated climate change on the ocean, including significant local extinction of all warm-water coral reefs, despite limiting warming to 1.5°C (IPCC 2019). These findings were further supported by the IPCC's Sixth Assessment Report (AR6) in 2021, which highlighted the importance of blue solutions and seascapes in global climate action (IPCC 2021).

In 2019, for the first time in COP history, COP25 recognised the ocean as an "integral part of the Earth's climate systems", emphasising the need to ensure the "integrity of ocean and coastal ecosystems" (World Ocean Initiative 2019). However, more momentum is needed to convert these commitments into action. As of August 2023, only 41 countries are signatories to the Because the Ocean initiative (Because the Ocean 2023). Large emitters, such as Brazil, China, India, and the USA, are not yet members, despite having large coastal regions and populations that will be severely impacted.

> **~38% of all SDG targets are dependent on ocean sustainability. Yet, SDG 14 is one of the least funded by ODA providers.**

The governance of the ocean is not a novel concept; however, like climate change and energy, its transboundary nature and the involvement of several stakeholders complicate it. This inherent diversity of interests leads to regime complexities and challenges in developing comprehensive regulatory systems (Folami 2017; Keohane and Victor 2010). The institutional arrangement is another spectrum of the regime complex that needs further exploration to understand the role of different stakeholders. These multitudes of stressors and their cumulative impact cannot be managed in silos. It is, therefore, crucial to advocate for a suitable governance framework and institutional coherence along with science- and technology-driven initiatives to effectively respond to the growing pressures on the ocean. It is necessary to shift the focus of conservation and sustainability from the margins to the mainstream in tandem with national, regional, and global economic growth by highlighting the holistic value-add from the perspective of a sustainable blue economy. Finally, science and policy are crucial in bridging some of these gaps and providing solutions for effective implementation. While this science-policy interface plays a critical role in natural resource management, this is more complex and challenging for the ocean due to its shared nature.

Our study is divided into three thematic sections: Science, Impact, and Governance. Section 1 highlights the effect of anthropogenic emissions on ocean warming, acidification, and ocean carbon storage capacity. Section 2 discusses the impact of climate change on the jobs and growth in blue economy sectors and the sustenance of coastal communities. Section 3 examines the regime complex in ocean governance and institutional coherence. To highlight this regime complex, the study illustrates three aspects of ocean governance – regulatory, regional, and issue-based.

2. Climate change is altering ocean dynamics

2.1 Ocean warming and thermal expansion

Over the past century, the ocean has warmed faster than it has in the last 11,000 years (IPCC 2021). The ocean's heat capacity is almost 300 per cent higher than the atmosphere's, and since the 1950s, the ocean has absorbed nearly 93 per cent of additional heat from anthropogenic warming (Schmitt 2018; Roxy et al. 2020). This has contributed to global sea level rise due to thermal expansion. In the coming decades, this is likely to worsen. Land inundation due to sea-level rise and cross-country migration is already a reality for some low-lying countries such as Bangladesh, Dominica, Kiribati, and Tuvalu.

Meanwhile, marine heatwaves are another grave consequence of ocean warming, adversely affecting marine biodiversity. Since the 1980s, marine heatwaves have doubled in frequency, and marine heatwave days per year have increased by 50 per cent, with human influence being a likely contributor since 2006 (IPCC 2021; Smale et al. 2019). This has resulted in widescale disruption to the carbon and nutrient cycles and the extinction of local marine species. The "heat dome" over western Canada in June 2021 resulted in the death of over one billion marine species along Canada's Pacific coastline (Cecco 2021).

2.2 Ocean acidification

Ocean acidification is another direct consequence of rising atmospheric CO_2 emissions. Over the last 250 years, global atmospheric CO_2 concentrations have increased by 50 per cent, rising from 280 ppm in pre-industrial times to 420.50 ppm in May 2023 (NOAA 2022; Miles 2018). Without ocean CO_2 uptake, current atmospheric CO_2 concentrations would have risen to well over 450 ppm, driving far more adverse climatic impacts than those witnessed today (Quéré et al. 2015; Doney et al. 2009; Sabine and Feely 2007). This oceanic CO_2 uptake, however, is not benign; it lowers ocean pH levels, fundamentally altering ocean chemistry and resulting in ocean acidification. This phenomenon is commonly referred to as the "other CO_2 problem" (Doney et al. 2009).

> **Rising emissions and sea surface temperature have destroyed 25–50% of the world's coral reefs with ~60% currently under threat.**

According to the IPCC *Fifth Assessment Report* (AR5), surface ocean pH has decreased by almost 0.1 pH unit since pre-industrial times (IPCC 2014). This equates to a 30 per cent increase in the ocean's acidity during this period (NOAA 2020a). In a business-as-usual (BAU) scenario, by 2100, the surface ocean water pH is predicted to drop to 7.8, which will increase ocean acidity by 150 per cent, a rate not experienced in over 400,000 years (Borunda 2019).

Ocean acidification adversely affects marine biodiversity, such as phytoplankton and calcium carbonate organisms like corals, oysters, sea urchins, etc. Studies estimate that 25–50 per cent of the world's coral reefs are already destroyed, with nearly 60 per cent under threat (UNEP 2020). This raises significant concerns given that corals cover only 0.1 per cent of the ocean but support 25 per cent of all marine species on the planet, provide livelihood opportunities to 500 million people worldwide, and contribute nearly USD 1 trillion to the global economy (WWF 2020a; UNEP 2019a).

2.3 Ocean carbon storage

The ocean is the largest carbon sink in the world, with a capacity of 38,100 GtC, almost 16 times greater than soil and vegetation (2,410 GtC) and 50 times more than the atmosphere (760 GtC) (Sallée 2018). Despite growing research globally on the impact of rising temperatures and anthropogenic emissions on ocean carbon storage (OCS), there is no unanimous conclusion about the ocean as a permanent carbon storage space.

Some studies suggest that OCS has strengthened over the last decade. However, this has been chalked up to greater inter-annual climate variability and changes in wind patterns and SST, which determine CO_2 solubility (DeVries, Holzer, and Primeau 2017). Other studies concur that the regained strength may be lost in the future since ocean warming will increase the temperature gradient between the surface water and lower layers, reducing vertical mixing and resulting in greater stratification. This will negatively affect CO_2 solubility in surface water. The net effects of climate change are estimated to reduce the total anthropogenic CO_2 column inventory[1] in the ocean by 7.1 per cent by 2100 (Wang, Cao, and Li 2014).

A study by the Massachusetts Institute of Technology found that since 1982, as temperatures have risen, the amount of carbon removed from the atmosphere and stored in the deep ocean has decreased by 1.5–2 per cent (Chu 2017). This is further supported by the IPCC AR6, which states that ocean carbon sinks are lower in higher-emission scenarios, resulting in more CO_2 left in the atmosphere (IPCC 2021).

3. Climate change impact on jobs, growth and sustenance

Under the current growth trajectory, the global value added (GVA) by the ocean economy will peak at USD 3 trillion and provide 40 million full-time equivalent jobs by 2030 (OECD 2016). However, the overall ocean asset value (natural capital) is far greater at USD 24 trillion (Commonwealth Secretariat 2022; ADB 2021). The High-Level Panel for a Sustainable Ocean Economy states that every dollar invested in a sustainable ocean economy will yield five dollars in return, resulting in a rate of return of 450–615 per cent between 2020 and 2050 (Hoegh-Guldberg et al. 2019).

The blue economy calls for better stewardship of ocean resources to improve human health and social equity and reduce environmental and ecological strains (Commonwealth Secretariat 2022). This includes sectors such as coastal restoration, fisheries, offshore renewable energy, and tourism and recreation. To highlight the impact on jobs, growth, and the sustenance of coastal communities, the following section will focus on the fisheries sector, given that it supports 10–12 per cent of the world's population and is one of the main drivers of the blue economy (OECD 2016; Ababouch 2015).

The fishery industry is crucial for achieving SDG 1 (No Poverty), 2 (Zero Hunger), and 8 (Decent Work and Economic Growth) due to its contribution to food and livelihood security and economic growth (FAO 2018a). In 2020, global fish production reached an estimated sale value of USD 406 billion (FAO 2022). Excluding China, which accounted for 35 per cent of the global fish production, other significant producers in 2020 include Asia (35 per cent), America (12 per cent), Europe (10 per cent), Africa (7 per cent), and Oceania (1 per cent) (ibid). Marine fisheries support the livelihoods of 200 million people – equal to the combined population of France, Germany, and Spain (as of 2023) – with women accounting for 19 per cent and 50 per cent of those employed in the primary and secondary sectors, respectively, and fulfil the nutritional needs of another three billion (FAO 2018a; United Nations 2017a).

> **Biologically sustainable levels of fish stock have dropped from 90% to 64.6% in the last five decades.**

In the last few decades, capture production has stagnated, with an expected growth by only 1 per cent through 2025, as most of the world's capture fisheries are fully fished and have no further potential for increasing production (FAO 2016). In the last 30 years, the percentage of biologically sustainable fish stocks has decreased from 90 per cent (1990) to 64.6 per cent (2019) (FAO 2022). Model projections forecast that climate warming will further reduce net marine primary production globally (Krumhardt, et al. 2016). For instance, under RCP 8.5, the maximum catch potential in the EEZs will decrease between 7–12.1 per cent globally by 2050, with the decline far greater at the regional scale (FAO 2018c).

With the growing population and subsequent increase in food demand, this decline in capture production is a sign of concern, particularly for developing and emerging economies. First, the fisheries sector's percentage contribution to GDP is higher in developing countries than developed countries, if the production scales are kept equal (Cai, Huang, and Leung 2019). This GDP contribution ranges between 3–15 per cent in countries such as Bangladesh, Cambodia, Comoros, Ghana, Mozambique, and Uganda (UNCTAD 2017; Serpong, Quaatey, and Harvey 2005). Secondly, developing countries account for 97 per cent of the world's fisher workforce (Kituyi and Thomson 2018). Thirdly, this decrease will likely worsen due to over-exploitation and illegal, unreported, and unregulated (IUU) fishing. It is estimated that one in every five fish caught globally is through IUU fishing, valued at nearly USD 10–23 billion annually (FAO 2020b; United Nations 2021). Hence, rising anthropogenic emissions, warming temperatures, and the absence of effective fisheries management will decrease national GDP and economic growth, adversely affect livelihood opportunities, and increase food insecurity, particularly in the Global South.

1. A CO_2 column inventory is a water column inventory of anthropogenic carbon dioxide.

Considering this, it is critical to build the adaptive capacity of marine ecosystems and coastal communities, decarbonise sectors, and develop robust governance mechanisms to improve ocean stewardship and management of its resources. Despite our critical dependence on the ocean and its resources, numerous unsustainable and ill-managed human activities have strained the ocean's health. These long-term challenges are far from solved by a single nation. This is the crucial catalyst for discussing global ocean governance while taking into account the societal transformations of all economies and relevant stakeholders across the maritime domain.

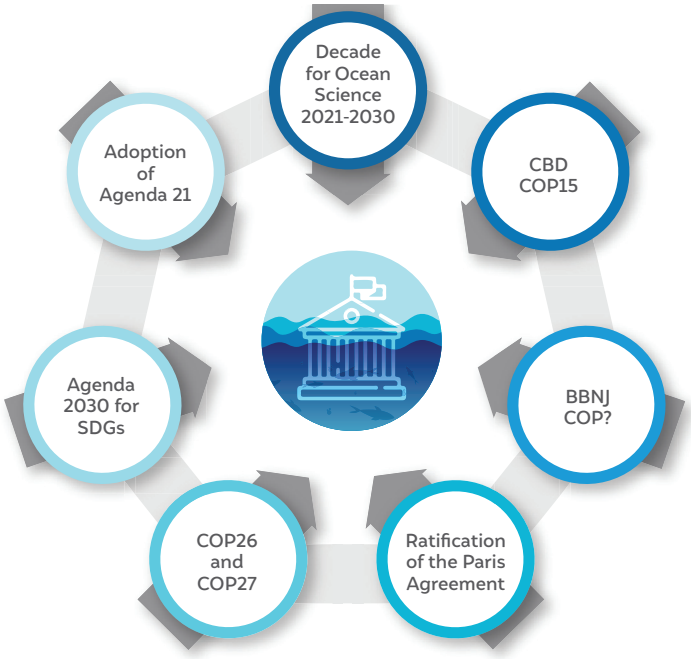
4. Governance of the ocean

The world must limit warming to 1.5°C to conserve, protect, and develop an integrated global sustainable ocean economy. Current emissions have resulted in nearly 1.15°C of warming since 1850–1900, with recent emissions reduction actions appearing inadequate to limit temperature rise to 1.5°C (WMO 2023; IPCC 2021). These efforts must increase fivefold to meet the 1.5°C target (IPCC 2019). Currently, steps to 'save the planet' remain insufficient, with little effort to mainstream the 'ocean dialogue' into the climate discourse. Furthermore, management and governance of the ocean are inadequate as most of the ocean falls under "no national jurisdiction" (Pretlove and Blasiak 2018). Although UNCLOS addressed critical challenges regarding the ownership of marine resources and economic activities in the marine environment, the convention failed to address the problems in the marine ABNJ, creating a perfect example of the tragedy of the commons.

The ocean provides a vast resource base with diverse uses and benefits. Hence, the participation of many stakeholders with various skills and interests across different levels of governance is required to overcome challenges related to the marine environment. Ocean governance has seen some noticeable momentum to reverse the declining health of the ocean and interlinking the ocean with climate change (Figure 1).

COP26 was unsuccessful in keeping "1.5°C alive", succumbing to several issues, including a lack of ambition by developed countries in emission reduction, climate finance, and coal phase-out/down (Carbon Market Institute 2021). However, the conference emphasised the importance of building linkages between biodiversity and the climate crisis, including driving forward Fiji's COP23 Presidency (2017) initiative to establish work programmes that strengthen ocean-based action (ibid). Other significant ocean-based announcements included a multi-stakeholder blue finance collaboration, the establishment of the world's first 'mega' MPA in the Pacific Ocean, the launch of the Blue Wall Initiative, and a multi-country pledge to develop a net-zero shipping sector (Hindley 2021; Economist Impact 2021). COP27 emphasised the need to strengthen ocean science and ocean-based solutions to address climate change.

Figure 1 Global action to improve ocean-based action and commitments



Source: (Harris 2019); Authors' compilation

Yet, considerable efforts are needed to mainstream the ocean into NDCs and climate policies. As of November 2021, only 54 NDC submissions from coastal states include at least one ocean-based action (Carbon Market Institute 2021). These must go beyond announcements and deliver on commitments (unlike the unsuccessful delivery of USD 100 billion in climate finance to developing countries). In this regard, it is critical to explore the ocean's existing institutional and governance landscape and identify gaps and loopholes rather than create additional institutions that carry forward legacy issues in management.

Without finance, commitments cannot be delivered. Nearly 38 per cent of all SDG targets are dependent on ocean sustainability, particularly SDG 1 (No Poverty), SDG 2 (Zero Hunger), and SDG 13 (Climate Action) (Singh et al. 2018). Despite this massive potential, in 2019, SDG 14 received the least funding from official development assistance (ODA) providers, amounting to USD 1920.12 million, a mere 0.77 per cent of the total (OECD 2020). This is also far below the average amount of USD 14,244.44 million if the total funding provided by ODA, is split equally across all SDGs.

Despite some ocean-focused action, there is still a critical need to accelerate ambitions into action. This requires an in-depth understanding of the regime of ocean governance and its complexities and new avenues of blue finance. Given the scope of this study, this paper does not focus on the latter.

4.1 The regime complex in ocean governance

International environmental governance requires societal transformations of all economic actors and negotiations among various interested parties and stakeholders (Najam, Christopoulou, and Moomaw 2004). In the context of the ocean, this inclusive form of planning is described as 'integrated ocean governance', where different marine sectors and stakeholders aim to maximise their benefits while minimising their adverse environmental impacts (FAO 2016). This inherent diversity of the interested parties results in a regime complex or "an array of loosely coupled, partially overlapping, non-hierarchical institutions with more than one international agreement or authority" (Keohane and Victor 2010; Alter and Raustiala 2018). Ocean governance has many features of a regime complex, similar to the governance of energy trade and investment, climate change, and politics of international regime complexity (Ghosh 2011; Keohane and Victor 2010; Alter and Meunier 2009). The transboundary nature and involvement of multiple stakeholders make ocean governance a dynamic function of interactions between stakeholders, scientific and social institutions and organisations, and communities within existing policy regimes.

Following Keohane and Victor's (2010) and Ghosh's (2011) research, this study identifies three aspects of regime complex in ocean governance: a) regulatory, b) regional, and c) issue-based. The analysis is based on the review of 62 marine agreements and conventions (complete list available in Annexure 2) at the global (19) and regional (43) levels, as showcased in Figures ES1 and ES2.

Regulatory aspect

Figure ES1 illustrates the regulatory aspect of ocean governance. The horizontal axis represents functionality, i.e., the regulatory nature of marine agreements and conventions (legally binding or non-binding). The vertical axis highlights the spatial dimension, where 'centralised' implies governance in international waters, and 'decentralised' means focusing on a specific sea or ocean. The analysis highlights that 13 out of 62 agreements and conventions are centralised, with nearly 70 per cent established in a decentralised manner. Furthermore, 46 out of 62 marine agreements and conventions are decentralised and legally binding. Nearly 84 per cent of all agreements and conventions are legally binding, while centralised and non-binding account for a little less than 10 per cent of the portfolio. Currently, ocean governance is dominated by several regional (decentralised) agreements and conventions. Many of these agreements have significantly shaped the course of ocean governance.

The UNEP Regional Seas Programme (RSP) is an example of decentralised governance. It integrates SDGs across strategic documents, enforces measures, optimises the use of resources for effective marine conservation, and facilitates international cooperation to address regional marine challenges (UNEP 2015a; Johnson et al. 2014). The study explores all 18 Regional Seas Convention and Action Plans (RSCAPs), of which 14 are legally binding conventions and the remaining four are action plans[2] (Table 1).

2. Action plans outline the strategy for the RSP based on regional environmental concerns. An action plan becomes legally binding when complemented by a convention establishing the legal framework and associated protocols for specific issues mentioned in the RSP (UNEP 2015b).

Table 1 The UNEP RSP comprises three types of Regional Seas Convention and Action Plans across 18 regions

Type of RSCAPS	Definition	Region
UNEP-administered	RSCAPS established, administered, and provided with financial, technical and secretariat assistance by UNEP.	Includes five conventions and two action plans: Cartagena Convention (Caribbean region), East Asian Seas Action Plan, Nairobi Convention (East African region), Barcelona Convention (Mediterranean region), North-West Pacific Action Plan, Abidjan Convention (West African region) and Tehran Convention (Caspian Sea)
Non-UNEP-administered	RSCAPs established under the auspices of the UNEP, but other regional bodies provide administrative and secretariat assistance.	Includes six conventions and one action plan: Bucharest Convention (Black Sea), Antigua Convention (North-East Pacific region), Jeddah Convention (Red Sea and Gulf of Aden), Kuwait Convention (ROMPE Sea area), South Asian Seas Action Plan, Lima Convention (South-East Pacific region), and Noumea Convention (Pacific region)
Independent	RSCAPs not set up by the UNEP but cooperate with the RSP.	Includes three conventions and one action plan: Marine Strategic Plan 2015-2025 (Arctic region), CCAMLR (Antarctic region), Helsinki Convention (Baltic Sea), and OSPAR Convention (North-East Atlantic region)

Source: UNEP. 2020b. "Regional Seas Programme," UN Environment Programme. Accessed June 07, 2021.

Challenges and achievements of Regional Seas Convention and Action Plans

The Helsinki Convention was one of the first regional treaties to include land-based sources of pollution and combat oil-based marine pollution from the entire drainage basin. Despite achieving Aichi Target 11[3], there are still several hurdles that need to be addressed by Baltic countries (Table 2). First, the establishment of MPAs. Only 1.8 per cent have robust, long-term management plans (WWF and Sky Ocean Rescue 2019). Secondly, while eight Baltic states have management plans, these cover less than 10 per cent of national marine and coastal regions (ibid). Thirdly, the MPAs in the Baltic Sea are widely distributed and lack representation of diverse species (WWF and Sky Ocean Rescue 2019). Finally, overlapping conventions under HELCOM could create complexities with management in this region. For instance, in the Baltic region, the Convention on Fishing and Conservation of the Living Resources in the Baltic Sea and the Belts (Gdansk Convention) focuses on fisheries management and conservation of marine species. A lack of coordination between the Helsinki and Gdansk Conventions could be a reason for inadequate fisheries management; however, this needs to be explored in detail to fully understand the scope of the two conventions and their gaps in implementation.

The OSPAR Convention, on the other hand, is a guiding instrument for cross-sectoral and regional cooperation due to its multilateral connections with other organisations such as the Arctic Council, CBD, FAO, HELCOM, IMO, International Seabed Authority (ISA), and North-East Atlantic Fisheries Commission (NEAFC) (OSPAR 2019). Moreover, to understand scientific processes and carry out regular assessments and monitoring in the North-East Atlantic region, the convention is enhancing its data lab under the Biological Diversity & Ecosystem Committee (BDC) (OSPAR 2019).

Finally, despite getting only a third of the funding allocated for convention-managed projects, the Nairobi Convention is a platform for efficient regional cooperation in developing and implementing national policies, in line with the convention, among East African nations. However, it still faces challenges, with effective integration of oil spill contingency plans into national policymaking (Table 2).

3. Aichi Target 11 states, "By 2020, at least 17 per cent of terrestrial and inland water, and 10 per cent of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem services, are conserved through effectively and equitably managed, ecologically representative and well-connected systems of protected areas and other effective area-based conservation measures, and integrated into the wider landscapes and seascapes" (CBD 2022).

Table 2 A snapshot of decentralised, legally binding conventions (Helsinki, OSPAR and Nairobi) under the Regional Seas Programme

Name of RSC	Types of RSC	Administrative body	Success and achievements	Challenges
The Helsinki Convention for the Protection of the Marine Environment of the Baltic Sea Area (Helsinki Convention)	Independent	Baltic Marine Environment Protection Commission (HELCOM)	• Recovering the Baltic cod stock; reducing toxic pollutants and eutrophication from nutrient emissions • 178 MPAs established, accounting for 13% of the convention area • Achieved: Convention on Biological Diversity (CBD) Aichi Target 11	• Influx of invasive species • Deep-water oxygen deficiency • Unsustainable fisheries management • Poor specie diversity and connection between MPAs
Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR Convention)	Independent	OSPAR Secretariat	• Reducing land-based pollution and dumping • Guiding instrument for cross-sectoral and regional cooperation • Area under MPAs accounts for 6.4% of the convention area	
Convention for the Protection, Management and Development of the Marine and Coastal Environment of the Western Indian Ocean (Nairobi Convention)	UNEP-administered RSP	Nairobi Convention Secretariat	• Platform for efficient regional cooperation in developing	• Lack of effective adoption and integration of oil spill contingency plans into national policymaking

Source: Authors' analysis

Other regional agreements and conventions

The Nauru Agreement Concerning Cooperation in the Management of Fisheries of Common Interest, or the Nauru Agreement, is a sub-regional binding agreement among eight Oceania nations.[4] The Western and Central Pacific (WPC) region is significant for the economies of the region and the global tuna supply, accounting for over 55 per cent of the global tuna catch (2019) and nearly 81 per cent of the Pacific Ocean tuna catch (WCPFC 2020). To conserve and protect the tuna stock in this region, the Nauru Agreement and other regional agreements, such as Tokelau Agreement and Palau Agreement, attempted to manage the region's tuna supply through the Vessel Day Scheme (VDS) (PNA 2021; Warner 2020). The Parties of the Nauru Agreement (PNA) lead Pacific regionalism and sustainable fisheries management for tuna in the WCP region (ANU 2020). These efforts have resulted in increasing fishing access by over 733 per cent, from USD 60 million (2010) to USD 500 million (2018), driven by independent efforts by the PNA to develop and own the Fisheries Information Management System, which is essential for monitoring resource status and VDS management (Warner 2020).

Centralised global agreements and conventions

Despite these regional developments in marine governance, most of the ocean surface lies in the marine ABNJ, which is not covered by regional agreements and conventions. Currently, only 1 per cent of the high seas are protected and face challenges such as a lack of clearly defined rules and ineffective management and enforcement, particularly for marine biodiversity and protection (Stallard 2023). The absence of coordinated action within and across sectors also undermines marine protection of the high seas (Freestone 2018). Hence, centralised global agreements and conventions, such as UNCLOS, MARPOL, PSMA, and CLC are crucial to lay down the framework for ocean management and governance, which regional and national policies can build on.

4. The Federated States of Micronesia, Kiribati, the Marshall Islands, Nauru, Palau, Papua New Guinea, Solomon Islands, and Tuvalu.

In January 2020, the IMO introduced a sulphur cap regulation (IMO2020) under the International Convention for Prevention of Marine Pollution for Ships Annex VI (MARPOL VI). This regulation calls to reduce sulphur concentration in bunker fuels used in shipping vessels from 3.5 to 0.5 per cent. The responsibility for enforcement, compliance, and monitoring lies with the states party to MARPOL 73/78 Annex VI, and ships not found compliant can be detained at the port of entry, or sanctions may be imposed for violations (UNCTAD 2019). Consistent with IMO regulations, a complimentary amendment to MARPOL 73/78, known as the carriage ban, came into force in March 2020. This amendment "prohibits the carriage of non-compliant fuel oil for combustion purposes for propulsion or operation onboard a ship, unless the ship has an approved exhaust gas cleaning system ("scrubber") fitted" (UNCTAD 2019; IMO 2020). Hence, IMO2020 restricts the sulphur content to 0.5 per cent, and the carriage ban bars the transfer of non-compliant fuel on board. This is a critical convention to reduce air pollution, especially since maritime transport accounts for nearly 90 per cent of all global trade carried out by sea and 3 per cent of global GHG emissions (UNCTAD, 2018b; Schlanger 2018; Yale Climate Connections 2021; IMO 2014). With growing maritime trade, this is expected to rise between 50–250 per cent by 2050 (IMO 2014).

The Agreement on Port State Measures to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated Fishing (PSMA), commenced in 2016, and is signed by 74 countries as of April 2023 (FAO 2022). It is the only legally binding international agreement that aims to combat IUU fishing and prevent IUU fishing vessels from accessing member ports and landing their catches (FAO 2020a). Since its commencement, the traffic of risky ships to PSMA member states has reduced. However, robust implementation suffers from delays due to limited timely and reliable data on vessels and their activities at sea (Selig, et al. 2022). Despite its challenges, PSMA exemplifies how a centralised global convention can force regional and national policies to enforce sustainable fishing practices to minimise ecological damage.

> **1/5 fish caught globally is through illegal, unreported, and unregulated fishing, with the global value at ~USD 10–23 billion annually.**

Ecosystems on the high seas account for nearly half of all biological productivity in the global ocean (Jensen 2020). To ease compliance, enforcement, and monitoring of the marine Biodiversity of Areas Beyond National Jurisdiction (BBNJ), it is critical that a legally binding international instrument distinctly defines the roles, responsibilities, and hierarchies of existing and new organisations such that regime complexities are not further propagated (Long 2019). In March 2023, the United Nations reached a breakthrough for the ocean when member countries agreed on the High Seas Treaty to ensure the protection and sustainable use of marine BBJN. Once adopted, the treaty will be legally binding and bring the marine BBNJ under common global management and monitoring. The Treaty stipulates provisions for equitable knowledge and technology exchange and sharing of co-benefits from marine genetic resources. In the future, this Treaty could aid in filing existing policy gaps and shield the marine commons from exploitation, as it requires compulsory environmental impact assessments ahead of any new exploitation of marine resources in ABNJ (Parkes 2023; Tsioumanis 2021; Blasiak, et al. 2018). However, what deserves closer attention is how the treaty defines the "exploitation" of marine BBNJ resources and how it would hold countries and companies accountable and liable for their actions in the case of marine degradation on the high seas?

The battle between legally binding vs non-binding/ voluntary agreements is not limited to the climate space as witnessed in the Kyoto and Paris climate regimes. These differences in governance mechanisms are also prevalent in ocean governance and are driven by similar challenges. For instance, discussions on voluntary commitments often focus more on weaknesses than advantages. However, focusing on the latter would foster greater flexibility in management plans, greater willingness to participate among states (as noticed with UNFCCC and the Paris Agreement), and greater effectiveness in dealing with uncertainty and urgent issues (Kao, Pearre, and Firestone 2012). In contrast, legally binding conventions incite greater political commitments, establish firmer institutions and financial foundations, outline clearer pathways and mandates for action over a set period (as noticed with the Montreal Protocol), and ensure greater regulatory checks and balances through legal compliance and enforcement (ibid).

The South Asian Seas Action Plan (SASAP) is an RSP supported by Bangladesh, India, Maldives, Pakistan, and Sri Lanka. Since the SASAP has no legal convention, the action plan follows existing global maritime conventions such as UNCLOS and MARPOL that all five nations are party to (Arif and Karim 2013). Apart from some activities related to marine conservation, this non-binding plan has been relatively unsuccessful in preventing, reducing, and controlling marine litter due to inadequate institutional systems for the management and collection of real-time data, lack of political will and institutional enforcement of international agreements and regulations, and absence of economic and market instruments for marine litter management (SACEP 2018).

Similarly, the North-west Pacific Action Plan (NOWPAP) has been unsuccessful in promoting ecological integrity and regional marine sustainability. NOWPAP member countries (China, the Republic of Korea, Japan, and the Russian Federation) have recorded more endangered species than the 143 listed in the IUCN red list, with climate change, habitat destruction, and invasive species driving this stark decline (UNEP 2018). With Japan exiting the International Whaling Commission (IWC) and potentially shifting whaling efforts to its territorial waters, this region could be exposed to more threats. Previously, Japan conducted large-scale whaling on the high seas under the mantle of "scientific research" to evade IWC mandates (Normile 2019).

Given this, we conclude in instance of limited capacity and political will, marine agreements and conventions could start as non-binding agreements (SASAP and NOWAP) to ensure some form of agreement-based national and regional legislation for management. Over time, once these agreements are in place regionally, a legally binding convention or protocol can be established, which would encourage greater regional cooperation and compliance and enforcement for regional management beyond EEZs, based on national circumstances.

> **Only 30% of agreements and conventions are centralised, despite the ABNJ accounting 64% of the ocean's surface.**

Regional aspect

Marine issues are prioritised differently depending on the ocean basin, the surrounding nations, and the strength of their economies. Based on our analysis of 62 marine agreements and conventions, most marine governance frameworks in the Atlantic Ocean focus on MPAs and biodiversity protection, fisheries, and conservation of marine species. This is more or less similar to centralised (all oceans) marine conventions that emphasise MPAs and biodiversity protection, oil spills, and conservation of marine species (Figure ES2).

Unlike the Atlantic Ocean, the Indian Ocean is governed by fewer agreements and conventions with greater emphasis on integrated ecosystem-based management, sustainable development and management, MPAs and biodiversity protection, and effluent discharge. Similarly, the Southern Ocean also has few marine agreements and conventions. However, the Convention of Conservation of Antarctic Marine Living Resources (CCAMLR), an independent RSP, is expansive in its context and broke new ground when it extended beyond the Antarctic Treaty area (Wenzel et al. 2016). The agreements in the Southern Ocean primarily focus on settling disputes on territorial claims, promoting peaceful and scientific cooperation, conserving marine species – notably smaller organisms such as krills – and establishing MPAs in the ABNJ.

Issue-based aspect

Over 56 per cent of marine agreements and conventions (inclusive of global and regional agreements and conventions) focus on MPAs and biodiversity protection, 42 per cent on fisheries and conservation of marine species, and 41 per cent on integrated ecosystem-based management. Global agreements and conventions also feature oil spills, while regional agreements and conventions focus on sustainable development and management. However, issues such as reducing GHG emissions/decarbonisation and ocean acidification have limited coverage under global conventions such as MARPOL, the London Convention/London Protocol (LC/LP), and CBD.

The MARPOL regulation for reducing GHG emissions from shipping has been discussed earlier in this section. In 2010, the CBD agreed on a moratorium on ocean iron fertilisation (OIF), a form of geoengineering, which was reinstated in 2016. Decision IX/16C of the CBD states that adequate scientific evidence on associated risks to biodiversity, economy, society, and culture and a globally transparent and effective regulatory mechanism is essential to advancing OIF. The only exception is under Article 3 for small-scale scientific studies in controlled settings, only if they are "justified by the need to gather specific scientific data and are subject to thorough prior assessment of the potential impacts on the environment", otherwise OIF cannot be conducted (GESAMP 2019). The LC/LP went further by placing a complete ban on OIF in 2013 (Geoengineering Monitor 2020). Geoengineering involves a wide range of risks and uncertainties in understanding and predicting the effect of large-scale deployment in the marine environment and its ecosystems, technological research, political intention, and public trust (Ghosh 2019).

Over half of the agreements and conventions focus on MPAs and biodiversity protection, receiving significant importance at the issue-based and regional levels (Figure ES2). Despite this, the effectiveness of MPAs is still a matter of discussion. A decade ago, under the CBD, the international community committed to protecting 10 per cent of the ocean by 2020 (Aichi Target 11). To date, only 8.16 per cent of the ocean is protected, of which only 2.4 per cent is fully/highly protected from fishing impacts, and a mere 0.5 per cent of the ABNJ is off-limits for industrial exploitation (Protected Planet 2022; UNEP 2022; Marine Conversation Institute 2022; Heffernan 2018). It is also important to note that not all MPAs are the same. For instance, although 71 per cent of the UK's EEZs are MPAs, only 5 per cent of offshore MPAs ban bottom trawlers (Marine Conservation Society 2021; Marine Conservation Institute 2020b). This disconnect between the two must be bridged by effectively redefining MPAs and their purposes. This is important for achieving the 30x30 global target to "ensure and enable that by 2030 at least 30 per cent of terrestrial, inland water, and coastal and marine areas" are "effectively conserved and managed" through "effective area-based management measures" (CBD 2022b). This was agreed upon with the adoption of the

Only 2.4% of the ocean is fully/highly protected from fishing impacts, and 0.5% of the ABNJ is off-limits for industrial exploitation.

Kunming-Montreal Global Biodiversity Framework (GBF) at the CBD COP15 in December 2022. The challenge now remains with distilling the 30x30 target into practice, including action at the national and regional levels and in the high seas, convergence with the High Seas Treaty and finding interlinkages with regional conventions such as OSPAR and Barcelona that establish MPAs in the high seas.

Marine plastic litter is another particularly concerning issue, with nearly 11 million tonnes entering the ocean annually (European Commission 2022). Without effective collective international response and action, this number will triple over the next 20 years (Parker 2020). At the current rate of land-based and sea-based plastic dumping, marine plastic debris will outweigh fish in the ocean by 2050 (Williams 2016). This will severely affect livelihood and nutrition sustenance, particularly for low-lying island nations and coastal communities involved in small-scale and community fishing.

Currently, there are 0–4 centralised agreements and conventions focusing on effluent discharge and the dumping of wastes into the ocean. Global governance of marine plastic is particularly challenging and fragmented due to lobbying, the absence of accountability and commitment by stakeholders, and the durability and dispersal of microplastics in the ocean (Dauvergne 2018; Gottlieb 2021). Although the 1973 Annex V of MARPOL (which entered into force in 1988) bans ships from dumping plastics in the ocean, the ocean has not significantly benefited from this ban, as almost 80 per cent of marine plastics come from land-based sources (Borrelle et al. 2017; IUCN 2018). In the decades since MARPOL, steps to curb land-based marine pollution have included voluntary commitments (UNEP Clean Seas Campaign), vague targets lacking effective reduction strategies (Rio+20), and the development of a planning tool to monitor progress (NOAA-UNEP Honolulu Strategy) (Borrelle et al. 2017).

In March 2022, the world witnessed a breakthrough moment at the fifth United Nations Environmental Assembly (UNEA 5.2), when 193 delegates agreed to set up an Intergovernmental Negotiating Committee (INC) to create an international legally binding "instrument" on plastic pollution by the end of 2024 (Nandi 2022). The resolution focuses on plastic pollution in marine and other environments through an entire lifecycle approach considering national circumstances and capabilities to adopt and implement policies (ibid). What is left to see is how this "instrument" will fare against curbing pollution from land-based sources that dominate marine plastic litter.

Multi-party partnerships

Since 2017, there has been a growing interest and focus on ocean issues at the G20 (Table 3). Although limited, such multilateral forums and agreements provide the building blocks for bilateral partnerships and act as stepping stones to foster greater scientific cooperation, business development, and technology transformation for more inclusive national and regional action.

To summarise, while the paper highlights some successes in ocean governance, significant challenges still need to be addressed. The current framework is loosely linked, resulting in overlapping interests among different groups, unplanned and uncoordinated management, lack of compliance, poor implementation, and limited monitoring and enforcement. Some significant challenges include lack of information, unclear ownership and responsibility of the high seas, overexploitation of marine resources, and absence of adequate adaptation and management mechanisms to protect marine resources in a changing world. This is fuelled by unsustainable human activities driven by the growing demand for energy, food, trade, transportation, and recreation and made worse by climate change, biodiversity loss, and pollution. Hence, ocean governance, including the high seas, needs to be integrated across all levels of government and should involve the private sector, academia, governmental institutions, and policy researchers (Pratikto 2016). Given this, the role of institutions is critical while discussing existing and upcoming marine agreements and conventions.

Table 3 Ocean-based action outcomes by G20 Presidencies[5]

G20 Presidency	Outcome
 Germany | 2017	Launched *Marine Litter Action Plan* to prevent and reduce marine litter through socio-economic aspects.
 Japan | 2019	Launched the G20 Implementation Framework for Actions on Marine Plastic Litter and Osaka Blue Ocean Vision to emphasise national initiatives to reduce marine pollution and plastic litter, promote sustainable ocean management through resource efficiency, and cut additional pollution by 2050, respectively.
 Saudi Arabia | 2020	Established the Global Coral Reef Research and Development (R&D) Accelerator Platform to fast-track R&D to protect, conserve and save the world's corals, as well as focused on increasing ocean resilience and ecosystem management.
 Italy | 2021	Supported the development of international seabed mining regulations, adoption and implementation of the Post-2020 GBF, and called on the need for a binding instrument for marine BBNJ; introduced the RFMOs and RSCAPs at the G20 to garner political momentum for better management of the fisheries and reduce marine litter, through land-based sources and discarded fishing gear.
 Indonesia | 2022	Established Ocean20 (O20) as an initiative for G20 countries, global companies, and civil society voices to realise commitments toward a sustainable and inclusive ocean. This includes leveraging market opportunities in the ocean economy, including coastal ecosystem restoration, sustainable blue blended finance models, blue economy and carbon, sustainable blue foods, and marine pollution.
 India | 2023	Adopted the Chennai High-Level Principles for a Sustainable and Resilience Blue/ Ocean-based economy. The principles prioritise ocean health and international cooperation promote social and intergenerational equity, sustainable use of the marine environment, and ocean finance.

5. This has been compiled based on relevant G20 Working Groups, Summit Outcomes and Ministerial Meetings.

4.2 Institutional coherence in the ocean regime complex

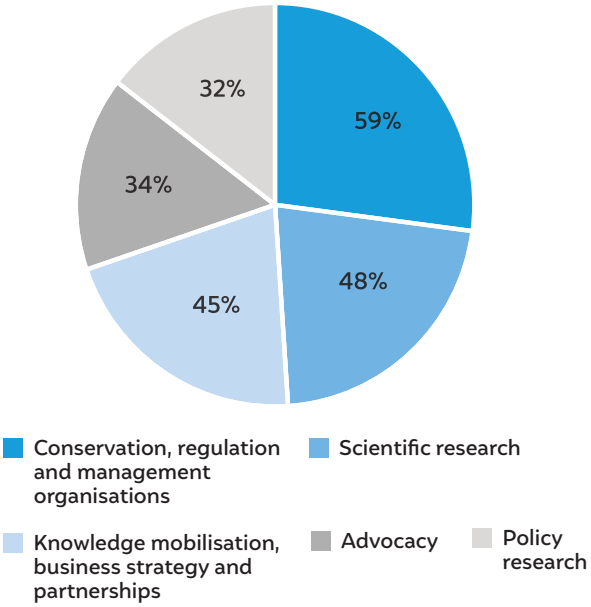
Institutions leverage power to enforce and enhance cooperation and interactions among different stakeholders. Institution building is paramount for effective governance and management of the ocean, with institutional frameworks a critical component for shaping governance at scale – local, national, regional, and global (Tarmizi 2010; Beer and Lester 2015).

A perplexing issue with ocean governance is the creation of new institutions with every new issue identified (Tarmizi 2010). Although specialised institutions are required to address specific problems effectively, this trend can result in overlapping roles, resulting in an institutional complex that hinders progress in enforcement. In such cases, institutions work neither fully integrated nor entirely fragmented. This institutional complex has made sustainable development of the marine environment difficult. Moreover, given the disproportionate scale of regional vulnerabilities, a cohesive and integrated approach needs to be indigenous such that adaptation efforts account for the cultural and social aspects of local challenges.

This study highlights the current institutional complex for ocean governance. It evaluates 45 marine institutions (international, regional and intergovernmental and UN organisations; academia and scientific institutions; private sector and civil society organisations) (Annexure 3) to highlight the overlapping interaction across different functionalities. It explores specific functionalities, such as scientific research, policy research, conservation, management and regulation, advocacy, knowledge mobilisation, and building business strategies and partnerships.

The study highlights that nearly 59 per cent of the institutions are involved in conservation, management, and regulatory functions, 48 per cent work in scientific research, and 45 per cent in knowledge mobilisation and building business strategies and partnerships (Figure 2). It also finds that a quarter of the assessed institutions focus only on a specific function, while 39 per cent and 30 per cent are bi-functional and tri-functional, respectively (Annexure 3). Moreover, only 14 out of 45 institutions focus on marine policy research, of which only five institutions – Environmental Defense Fund (EDF), Food and Agriculture Organization (FAO), International Union of Conservation of Nature (IUCN), Natural Resources Defense Council (NRDC), and United Nations Environmental Programme (UNEP)– have a parallel focus on scientific research to build the science-policy interface.

Figure 2 Institutional arrangement in the ocean governance regime complex



Source: Authors' analysis

Institutional overlap can have both positive and negative implications (Young 1999). In some instances, it can develop unusual yet useful international conventions that involve the whole ecosystem. The Commission on Conservation of Antarctic Marine Living Resources (CCAMLR') regulates fishing and mandates an ecosystem approach (EA) for conservation in the Southern Ocean. It uses interlinked systems based on high-level scientific data and surveillance, enforcement, and market controls (CCAMLR 2020; Kock 2000). This holistic management approach makes the CCAMLR' a leader in high seas conservation, resulting in the world's first MPA in international waters in 2009 (Brooks 2013), and setting a precedent for more to follow.

The NEAFC is a dynamic fisheries conservation, management, and regulatory organisation in the North-East Atlantic Ocean. It works in coordination with the OSPAR Commission on the governance and management of this region. Although the two organisations have overlapping mandates, there is a difference in the type of mandates that each organisation has the legal

competence to enforce (NEAFC and OSPAR 2015). For instance, the OSPAR Convention explicitly excludes any articles on fisheries management. Still, it is responsible for assessing the environmental impact on fisheries and marine ecosystems in its convention area, while the activities of the NEAFC are limited to managing fisheries. In this context, in 2014, OSPAR and NEAFC adopted the 'Collective Arrangement between competent international organisations on cooperation and coordination regarding selected areas in areas beyond national jurisdiction in the North-East Atlantic' (Collective Arrangement) to manage human activities in the ABNJ. There are also discussions about expanding the Collective Arrangement to other global and regional organisations such as ISA, IMO, and the International Commission for the Conservation of Atlantic Tunas (ICCAT) (OSPAR 2021). In 2020, the NEAFC adopted new conservation and management measures for fish stocks based on scientific advice and in collaboration with the International Council for the Exploration of the Sea (ICES) (NEAFC 2020).

Similarly, the NEAFC and Indian Ocean Tuna Commission (IOTC) also stand out as regional fisheries management organisations (RFMOs) of the PSMA convention. The most noticeable features of these organisations include aligning existing fisheries port state measures[6] and incorporating national policies in line with PSMA to create a dynamic, integrated, digital data- and knowledge-sharing platform accessible to member countries, the commission, and port officials (WEF 2019). Finally, the NEAFC also mandates a vessel to submit a notification of entry three days beforehand to confirm its compliance with NEAFC-PSMA regulations at designated ports (ibid).

Governance in the Pacific Ocean also features examples of cross-commission institution collaboration. This includes the Western and Central Pacific Fisheries Commission (WCPFC) and the Inter-American Tropical Tuna Commission (IATTC) due to an overlap in convention areas and conservation of similar marine species (Albacore Tuna stocks and Bigeye tuna) (WCPFC 2006). On the high seas, the WCPFC overlaps with RFMOs, such as the South Pacific Regional Fisheries Management Organisation (SPRFMO) and the North Pacific Fisheries Commission (NPFC). However, unlike

> **For effective institutional coherence, overlapping institutions must define clear boundaries and mandates for operation.**

the cooperation between the WCPFC and IATTC, the fish stocks managed by RFMOs differ from those operated by the WCPFC (WCPFC 2006), thus defining clear boundaries and mandates in managing and conserving specific fish stocks. Hence, it is critical for institutions to have coherence and coordination when addressing challenges in the marine environment (UNDP 2017; UNGA 2017).

5. Recommendations

While some regional progress has been made under the current ocean governance framework, it has also resulted in a regime complex. This loosely structured governance framework results in overlapping interests among different groups, unplanned and uncoordinated management, lack of compliance, poor implementation, and limited monitoring and enforcement. This results in challenges such as lack of information, unclear ownership and responsibility of the high seas, overexploitation of marine resources, and the absence of adequate adaptation and management mechanisms to protect marine resources. To address the impacts of climate change on the ocean economy, collaborative efforts across different components of the ocean regime are critical. Although these collaborative efforts sound rational, achieving them globally or even locally is challenging.

Based on the analysis presented in the study and our current understanding of complexities in ocean governance, we propose the following:

Promote inter-regional and legally binding conventions to improve coordination, collaboration, and compliance for sustainable management of the ocean

Although the Helsinki, OSPAR, and Nairobi Conventions successfully tackled SDG 14 targets and delivered region-specific solutions for marine pollution, biodiversity conservation, sustainable ocean management, and

6. "Port state controls are the existing inspection and control procedures in place in ports that govern the landing of fish, distinct from the standardised requirements put in place by the Port State Measures Agreement" (WEF 2019).

advanced regional cooperation despite facing financial constraints and challenges (Nairobi Convention), difficulties with coordination, collaboration, and compliance still exist.

First, more cross-sectoral work is still needed, even within the most successful UNEP RSP, to include relevant stakeholders and draw on interdependencies among SDG 14 targets that provide co-benefits for other SDGs. This includes greater coordination involving countries, regional organisations, businesses and industries, and the scientific community. Secondly, the current ocean governance architecture lacks inter-regional information dissemination and capacity-building. Inter-regional collaboration can establish a platform for knowledge exchange with relevant international experts with varying perspectives on the challenges and implementation of best practices and the development of financial mechanisms.

Thirdly, while non-binding agreements foster flexibility in management plans and a greater willingness to participate (as noticed with the Paris Agreement), legally binding conventions have fared better in inciting greater political impetus, establishing firmer institutions and financial foundations, outlining clearer pathways and mandates for action, and ensuring greater regulatory checks and balances through legal compliance and enforcement. Marine agreements and conventions could therefore start as non-binding voluntary agreements, such as SASAP and NOWPAP, which ensure some form of agreement-based national and regional legislation for management for countries and regions lacking technical and financial capacity and political will. Over time, once these agreements are in place regionally, a legally binding convention should be established. This will encourage greater regional cooperation and compliance based on national circumstances, and enforcement for regional management beyond EEZs.

Enhance marine biodiversity protection by re-defining MPAs and their purposes and building cross-sectoral partnerships across the entire ecosystem

To date, only 8.16 per cent of the ocean is protected, of which only 2.4 per cent is fully/highly protected from fishing impacts, and a mere 0.5 per cent of the ABNJ is off-limits for industrial exploitation (Protected Planet 2022; UNEP 2022; Marine Conservation Institute

Inter-regional partnerships can establish a platform for knowledge exchange for the implementation of best practices, and development of financial mechanisms.

2022; Heffernan 2018). Moreover, the UK example highlights that not all MPAs are the same. Highly protected MPAs ban all commercial and recreational fishing, aquaculture, and bottom exploitation and only permit partially regulated or unregulated boating and anchoring for recreational purposes (Marine Conservation Institute 2020b). Minimally protected MPAs cover 3.7 per cent of the world's ocean and allow for disruptive activities like commercial and industrial fishing, the use of destructive fishing gear (bottom trawlers and bottom purse seiners), hydrocarbon extraction, and mining, resulting in large-scale destruction of marine ecosystems. Hence, MPAs and their purposes need to be re-defined globally in order to ban such practices in protected regions.

Cross-sectoral partnerships can improve the monitoring and exchange of learning and help establish more holistic management of MPAs. For instance, OSPAR and NEAFC attempted cross-sectoral collaboration to identify ecologically significant marine areas in the ABNJ and formulate synergies between environmental and fisheries management. Thus, marine biodiversity protection requires integrating the entire ecosystem.

Establish a G20 Fisheries Focus Group to promote sustainable fishing practices for a sustainable blue economy

Since 1950, nearly six billion tonnes of fish and other marine invertebrates have been extracted, making the fishing industry a significant threat to marine wildlife (WWF, 2018). Over-exploitation of certain commercial species combined with intensive fishing has exacerbated the challenges of endangering marine fauna and ecosystems. Six of the world's top ten fishing countries are part of the G20. This calls for countries to exchange knowledge and skills about sustainable fishing and comply with fishery management systems.

In 2021, Italy's G20 presidency promoted RSCAPs and RFMOs to leverage their learnings and improve the sustainable management of the fisheries

sector, including the possible development of more sustainable fishing gears, to reduce overall ecosystem and biodiversity damage. There is currently a lack of consensus on sustainable fishing practices, particularly those that align with jobs, growth, and the sustainability of the sector. Hence, the G20 should establish a Fisheries Focus Group to understand, assess, and evaluate sustainable fishing practices and technological improvements in fishing gear. It should also bring together the expertise of marine research and policy institutions, small and commercial fisheries, and civil society organisations, with the aim to reduce fishing-gear-based marine litter and bycatch and excessive exploitation and degradation of marine ecosystems without compromising the growth and development of this sector. Integrated efforts towards small-scale fisheries can bring social, economic, and environmental benefits ranging from protecting marine fauna, generating employment, and minimising loss from discarding by-catch. These efforts would go hand-in-hand with building a sustainable blue economy and driving action towards achieving the SDGs.

Improve ocean data to enhance monitoring, evaluation, and decision-making processes for sustainable ocean management

Robust policies for sustainable ocean management and governance require reliable data and scientific insights on the ocean's social, environmental, and economic value, its contribution to society, and the impact of human activities on the marine environment.

First, we must utilise coastal and marine spatial planning to develop a global ocean data inventory to reduce data and information asymmetry, exchange knowledge and best practices, and improve monitoring and evaluation through cooperation and investment across various sectors and countries. The PNA-led Pacific regionalism succeeded in developing and owning the Fisheries Information Management System, which is essential for monitoring resource status and managing VDS. Secondly, out-of-date data points impede effective monitoring and evaluation (as seen with PSMA), which is critical for tracking the progress of national and regional action plans. Many developing countries need to address challenges such as inadequate institutional systems for collecting and managing real-time data (as with the SASAP) and economic infeasibility with continuous monitoring and evaluation. Hence, regional

Develop a global ocean data inventory to reduce data and information asymmetry, exchange knowledge and best practices and improve monitoring and evaluation.

collaboration could reduce the financial burden, improve regional security, and collate, share, and disseminate up-to-date data to assist with evidence-based decision-making.

Embed institutional resilience into the broader governance architecture of the ocean

Coherence and coordination among institutions are critical for addressing challenges in the marine environment (UNDP 2017; UNGA 2017). The dynamic nature of asymmetrical marine challenges needs to be assessed continuously in the ever-changing world. This calls for institutional resilience to assist with creating flexible institutions with the adaptive capacity to withstand change, bridge gaps, and drive action at different levels of governance. While a single institution cannot perform all functions, collaborative efforts between different institutions, commissions, and conventions can assist in embedding institutional resilience at varying levels of governance.

First, overlapping institutions must define clear operational boundaries and mandates for effective institutional coherence (such as WCPFC with RFMOs). Secondly, regional cooperation must go beyond the controls of a particular organisation. Such coordination could either involve collaborations between convention commissions that partially overlap over a common area to bridge the gaps between the two (such as WCPFC and IATTC) or are based on similar issues but involve different regulatory mandates (such as OSPAR and NEAFC). Thirdly, effective collaboration between centralised conventions and associated organisations has shown promise in the case of NEAFC and IOTC with PSMA. Aligning their priorities and objectives resulted in developing national policies aligned with PSMA, which assisted with enhancing monitoring and information and knowledge sharing to ensure greater compliance. Learnings from such collaborations must be shared inter-regionally and with other institutions for effective management of the ABNJ.

6. Way forward

Regional maritime insecurities are closely linked to climatic impacts, freedom of navigation, piracy, and the secure trade of resources, including energy and minerals. The dynamic nature of these asymmetrical marine challenges needs to be assessed continuously in the ever-changing world to create flexible institutions with the adaptive capacity to withstand change. Policy and institutional blueprints must be tailored to fit specific challenges and issues. Hence, institutional mechanisms and governance frameworks must provide a platform for all parties to have an equitable representation, interact directly, and form positive long-term relationships. This is particularly important for marginalised communities who typically lack representation in governance systems and integration in the formal economy. New and existing programmes must improve sector-disaggregated data analysis, enable targeted programmes, and strengthen social and environmental ecosystems to adapt to changes. While a single institution cannot perform all these actions, there is a need for institutional resilience that can enhance collaborative efforts between different regimes through information and technology transfer and provide an appropriate representation of all actors. The critical step is understanding the role of informed decision-making and implementing evidence-based policies to bridge the interlinkages between science and policy, as well as embed institutional resilience into the broader governance architecture of the ocean.

The recommendations are based on our understanding and analysis of the regime complex in ocean governance. It is critical to explore the ocean's existing institutional and governance landscape and identify loopholes in the existing marine governance domain so new institutions do not carry forward legacy issues in management. The critical takeaway from this report is that the ocean is not just a victim of climate change but also a source of a range of solutions. There are many avenues for further research, such as frameworks to strengthen and interlink national and regional policies to global conventions like the GBF and the High Seas Treaty; scaling up blue bonds for marine conservation and protection; and the role of institutions in shaping the fate of vulnerable nations and communities.

> **The ocean is not just a victim of climate change but also a source of solutions to combat planetary crises.**

Deploying these solutions requires widespread effort at all levels of governance to identify opportunities across sectors at scale for a sustainable blue economy.

The biggest wave to surf is the lack of political will and commitment towards ocean action; without finance, commitments cannot be delivered. Even though 38 per cent of all SDG targets depend on ocean sustainability, SDG 14 received the least funding from ODA providers in 2019. A critical outcome of COP29 must be to procure blue finance at scale for SDG 14. Investing in the recovery and protection of the ocean ecosystems and better valuing and managing its resources can rebuild the ocean's resilience and that of communities dependent on it. For this, new avenues of blue financing need to be explored, and the current narrow focus of climate finance needs to be broadened to incorporate blue economy-related risks. While the past G20 presidencies have focused on ocean action, the following presidencies under Brazil, and South Africa must continue this focus and enhance commitment towards the GBF for MPAs, build collaboration for ocean data mapping and availability, and mobilise appropriate de-risked finance at scale for ocean action. Such political platforms can provide the much-needed global will to enhance ocean action.

Finally, establishing the pace of this transition is critical to address climate and ocean action holistically. Current efforts to mainstream the ocean into the climate debate are limited; however, some positive outcomes are observed in the policy space. This includes success stories from CCAMLR, Helsinki Convention, Nauru Agreement, OSPAR Convention, and WCPFC and RFMOs that have broken out of silos and worked in an integrated manner. They have captured the essence of national, regional, and global cooperation, data sharing and management, institution building, and the science-policy interface between marine economic sectors and industries. With the UN Decade of Ocean Science for Sustainable Development or the 'Ocean Decade', we hope that actions to build a sustainable ocean economy will accelerate in the coming decade.

Annexures

Annexure 1

Methodology: Comprehensive review of marine agreements, conventions, and institutions

We follow a qualitative policy analysis approach in this study. We undertook a comprehensive review of the agreements and conventions related to marine ecosystems and institutions operating in this space.

a. Systematic qualitative policy analysis of agreements and conventions

First, we prepared a comprehensive list of agreements and conventions signed in global and regional contexts for the analysis, as we describe in Tables A1 and A2 in Annexure 2. We reviewed a total of 62 agreements and convention documents by assessing the goals, objectives, and progress of marine agreements and conventions to analyse the current regime complex in ocean governance. Out of 62, 19 are global, which implies that these agreements/conventions are applicable worldwide. The remaining 43 are regionally applicable to a specific ocean or sea. To understand the regulatory aspect of the ocean regime complex, we classified these agreements into two groups based on their type of implementation (legally binding or non-binding) and scope of implementation (global or regional).

Additionally, we classified the convention/regulation within the regional category based on the specified implementation region: Atlantic, Pacific, Arctic, Southern, Indian, regional seas, and all oceans. 'All oceans' implies the agreements/conventions applicable worldwide, whereas the others refer to specific regions. We followed A different classification structure for the second and third aspects – regional and issue-based, respectively. We classified the reviewed agreements/conventions were based on the issues they hope to resolve or address. The issue-based classification includes 11 different categories: effluent discharge, dumping of wastes, MPAs & biodiversity protection and conservation, conservation and protection of marine species, fisheries, reduction of GHG emissions/decarbonisation, ocean acidification, integrated ecosystem-based management, sustainable development and management, and geoengineering.

b. Systematic review of institutions in the marine policy space

In this analysis, we reviewed 45 institutions through the lens of their areas of operation. We reviewed their official websites, mainly targeting their 'About Us' pages and projects. We considered the descriptions these institutions provide about themselves to be the first source of information. In cases where this information remains unclear, the classification is based on our understanding of the focus areas of the institution as per its completed or ongoing projects. We then classified institutions into five functionalities: scientific research, policy research, conservation, management and regulation, advocacy, knowledge mobilisation, and building business strategies and partnerships. We describe the institutions covered in the study in Table A3. It is important to highlight that the list of agreements, conventions, or institutions covered in the study are comprehensive but not exhaustive. We have tried to cover all the major ones but do not claim that all are covered.

Annexure 2
List of marine agreements and conventions at global and regional levels

Table A1 Global marine agreements and conventions

Abbreviations	Policy name	Region	Type of Implementation
Agenda 21	UNCED Agenda 21	All oceans	Non-binding
Bonn Convention	Convention on the Conservation of Migratory Species of Wild Animals	All oceans	Non-binding
BUNKER	International Convention on Civil Liability for Bunker Oil Pollution Damage	All oceans	Legally binding
CBD	Convention on Biological Diversity – Jakarta Mandate and Decision IX/16C	All oceans	Legally binding
CFCLR	Convention on Fishing and Conservation of the Living Resources of the High Seas	All oceans	Legally binding
CITES	Convention on International Trade in Endangered Species	All oceans	Legally binding
CLC	International Convention on Civil Liability for Oil Pollution Damage	All oceans	Legally binding
FUND	International Convention on the Establishment of an International Fund for Compensation for Oil Pollution Damage	All oceans	Legally binding
ICRW	International Convention for the Regulation of Whaling	All oceans	Legally binding
INTERVENTION Convention	International Convention Relating to Intervention on the High Seas in Cases of Oil Pollution Casualties	All oceans	Legally binding
London Protocol	London Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter	All oceans	Legally binding
MARPOL	International Convention for the Prevention of Pollution from Ships	All oceans	Legally binding
OILPOL	International Convention for the Prevention of Pollution of the Sea by Oil	All oceans	Legally binding
OPRC	International Convention on Oil Pollution Preparedness, Response and Co-operation	All oceans	Non-binding
PSMA	Agreement on Port State Measures	All oceans	Legally binding
Ramsar Convention	Convention on Wetlands of International Importance Especially as Waterfowl Habitat	All oceans	Non-binding
UNCLOS	United Nations Convention on the Law of the Sea	All oceans	Legally binding
UNESCO MAB Programme	UNESCO Man and the Biosphere Programme	All oceans	Non-binding
UNFSA	UN Fish Stock Agreement	All oceans	Non-binding

Source: Authors' compilation

Table A2 Regional marine agreements and conventions

Abbreviations	Policy name	Region	Type of Implementation
Abidjan Convention	Convention for Cooperation in the Protection and Development of the Marine and Coastal Environment of the West and Central African Region	Atlantic Ocean	Legally binding
ACCOBAMS	Agreement on the Conservation of Cetaceans of the Black Sea, Mediterranean Sea and Contiguous Atlantic Area	Black and Mediterranean Sea	Legally binding
AEPS	Arctic Environmental Protection Strategy	Arctic Ocean	Non-binding
AIDCP	Agreement on the International Dolphin Conservation Program	Pacific Ocean	Legally binding
Antigua Convention	Convention for the Establishment of an Inter-American Tropical Tuna Commission	Pacific Ocean	Legally binding
Apia Convention	Convention on Conservation of Nature in the South Pacific	Pacific Ocean	Legally binding
ASCOBANS	Agreement on the Conservation of Small Cetaceans of the Baltic, North East Atlantic, Irish and North Seas	Atlantic Ocean	Legally binding
ASCOBANS	Agreement on the Conservation of Small Cetaceans of the Baltic, North East Atlantic, Irish and North Seas	Baltic, Irish and North Sea	Legally binding
Barcelona Convention	Convention for the Protection of the Mediterranean Sea Against Pollution	Mediterranean Sea	Legally binding only for the Mediterranean Action Plan
Bucharest Convention	Convention on the Protection of the Black Sea Against Pollution	Black Sea	Legally binding
CAOFA	Agreement to Prevent Unregulated High Seas Fisheries in the Central Arctic Ocean	Arctic Ocean	Legally binding
Cartagena Convention	Convention for the Protection and Development of the Marine Environment of the Wider Caribbean Area	Greater Caribbean Sea	Legally binding
CCAMLR	Convention on the Conservation of Antarctic Marine Living Resources	Southern Ocean	Legally binding
CCAS	Convention for the Conservation of Antarctic Seals	Southern Ocean	Legally binding
CFP	Common Fisheries Policy	Atlantic Ocean	Legally binding
East Asian Seas Action Plan	Action Plan for the Protection and Development of the Marine and Coastal Areas of the East Asian Region	East Asian Seas	Non-binding
EU IMP	EU Integrated Maritime Policy	Mediterranean, Baltic and Black Sea	Legally binding
Gdansk Convention	Convention on Fishing and Conservation of the Living Resources in the Baltic Sea and the Belts	Baltic Sea	Legally binding
Helsinki Convention	Baltic Marine Environment Protection Commission	Baltic Sea	Legally binding
Jeddah Convention	Regional Convention for the Conservation of the Red Sea and Gulf of Aden Environment	Red Sea and Gulf of Aden	Legally binding
Lima Convention	Convention for the Protection of the Marine Environment and Coastal Area of the South-East Pacific	Pacific Ocean	Legally binding

Abbreviations	Policy name	Region	Type of Implementation
London Fisheries Convention	London Fisheries Convention	North Sea	Legally binding
Madrid Protocol	Protocol on Environmental Protection to the Antarctic Treaty	Southern Ocean	Legally binding
MOSPA	Agreement on Cooperation on Marine Oil Pollution Preparedness and Response in the Arctic	Arctic Ocean	Non-binding
NAFO Convention	Convention on Cooperation in the Northwest Atlantic Fisheries	Atlantic Ocean	Legally binding
Nairobi Convention	Convention for the Protection, Management and Development of the Marine and Coastal Environment of the Western Indian Ocean	Indian Ocean	Legally binding
NASCO Convention	Convention for the Conservation of Salmon in the North Atlantic Ocean	Atlantic Ocean	Legally binding
Nauru Agreement	Nauru Agreement Concerning Cooperation in the Management of Fisheries of Common Interest	Pacific Ocean	Legally binding
NEAFC Convention	Convention on Future Multilateral Cooperation in Northeast Atlantic Fisheries	Atlantic Ocean	Legally binding
North Sea Fisheries Convention	International Convention for regulating the police of the North Sea fisheries outside territorial water	Atlantic Ocean	Non-binding
Noumea Convention	Convention for the Protection of the Natural Resources and Environment of the South Pacific Region	Pacific Ocean	Legally binding
NOWPAP	The Action Plan for the Protection, Management and Development of the Marine and Coastal Environment of the Northwest Pacific Region	Pacific Ocean	Non-binding
OSPAR Convention	Convention for the Protection of the Marine Environment of the North-East Atlantic	Atlantic Ocean	Legally binding
ROPME/Kuwait Convention	Kuwait Regional Convention for Cooperation on the Protection of the Marine Environment from Pollution	Persian Gulf	Legally binding
SAR agreement	Agreement on Cooperation on Aeronautical and Maritime Search and Rescue in the Arctic	Arctic Ocean	Legally binding
SASAP	South Asian Seas Action Plan	Indian Ocean	Non-binding
Science agreement	Agreement on Enhancing International Arctic Scientific Cooperation	Arctic Ocean	Legally binding
SEAFO	Convention on the Conservation and Management of Fishery Resources in the South East Atlantic Ocean	Atlantic Ocean	Legally binding
SIOFA	Southern Indian Ocean Fisheries Agreement	Indian Ocean	Legally binding
SPRFMO	Convention on the Conservation and Management of High Seas Fishery Resources in the South Pacific Ocean	Pacific Ocean	Legally binding
Tehran Convention	Convention for the Protection of the Marine Environment of the Caspian Sea	Caspian Sea	Legally binding
WCPF Convention	Convention on the Conservation and Management of Highly	Pacific Ocean	Legally binding

Source: Authors' compilation

Annexure 3
List of marine institutions analysed

Table A3 Institutional arrangement in the ocean governance regime complex

Institution	Scientific research	Conservation, regulation, and management	Policy research	Advocacy	Knowledge mobilisation, business strategy, and partnerships
AIIMS					
AOSIS					
CCAMLR'					
Coral Guardian					
Coral Reef Alliance					
CTC					
DSCC					
EDF					
FAO					
Greenpeace					
HELCOM					
ICES					
IMO					
IOC					
IOI					
IORA					
IOTC					
IPCC					
ISA					
IUCN					
NAFO					
Nature Conservancy					
NEAFC					
NOAA					

Institution	Scientific research	Conservation, regulation, and management	Policy research	Advocacy	Knowledge mobilisation, business strategy, and partnerships
NRDC					
Ocean Conservancy					
Oceana					
OCIA					
OSPAR					
PERSGA					
PICES					
POGO					
SCOR					
SEAFO					
SPREP					
SSCS					
Surfrider Foundation					
UNDP					
UNEP					
UNESCO					
UNIDO					
WHOI					
WOC					
WWF					

Source: Authors' analysis

References

Ababouch, Lahsen. 2015. *Fisheries and Aquaculture in the Context of Blue Economy*. African Development Bank. https://www.afdb.org/fileadmin/uploads/afdb/Documents/Events/DakAgri2015/Fisheries_and_Aquaculture_in_the_Context_of_Blue_Economy.pdf.

ACAPS. 2018. *Dominica – The Imapct of Hurricane Maria*. ACAPS. https://www.acaps.org/sites/acaps/files/products/files/20180131_acaps_disaster_profile_dominica_v2.pdf.

ADB. 2021. *Financing the Ocean Back to Health in Southeast Asia: Approaches for Mainstreaming Blue Finance*. Manila: Asean Calatytic Green Finance Facility and Asian Development Bank.

Adelman, Sam. 2015. "Climate Change and Human Rights: Climate Justice and the Rights of Small Island States," *Global Policy Journal*, 14 Nov. https://www.globalpolicyjournal.com/blog/14/11/2015/climate-change-and-human-rights-climate-justice-and-rights-small-island-states.

Allsopp, M., S. E. Pambuccian, P. Johnston, and D. Santillo. 2009. *State of the World's Oceans*. Springer.

Alter, Karen J., and Sophie Meunier. 2009. "The Politics of International Regime Complexity." *Perspectives on Politics* 7 (1): 13–24.

Alter, Karen J., and Kal Raustiala. 2018. "The Rise of International Regime Complexity." *Annual Review of Law and Social Sciences* 14: 329–349.

ANU. 2020. '"Fishing for Success: Lessons in Pacific Regionalism' Launch," Australian National University, 25 June. http://dpa.bellschool.anu.edu.au/news-events/stories/7646/fishing-success-lessons-pacific-regionalism-launch.

AOSIS. 2021. "Oceans Day Plastic Pollution Declaration." Accessed February 24, 2022. https://www.aosis.org/launch-of-ocean-day-plastic-pollution-declaration/.

Arif, Abdullah Al, and Md Ershadul Karim. 2013. "Marine pollution and the South Asian coastal states: a legal appraisal." *Macquarie Journal of International and Comparative Environmental Law* 1-23.

Bates, Nicholas R. 2019. "Ocean Carbon Cycle." *Encyclopedia of Ocean Sciences* 1: 418¬–428.

Because the Ocean. 2022. *The Initiative*. Accessed September 2022. https://www.becausetheocean.org/the-initiative/.

Beer, Andrew, and Laurence Lester. 2015. "Institutional Thickness and Institutional Effectiveness: Developing Regional Indices for Policy and Practice in Australia." *Regional Studies, Regional Science* 2 (1): 205–228.

Bennett, Nathan J. 2019. "In Political Seas: Engaging with Political Ecology in the Ocean and Coastal Environment." *Coastal Management* 47 (1): 67–68.

Berke, Jeremy. 2015. "Something Alarming Is Happening in the Gulf of Maine." *Business Insider*, November 10. https://www.businessinsider.com.au/cod-stocks-are-collapsing-in-the-gulf-of-maine-2015-11.

Bigg, G., T. D. Jickells, P. S. Liss, and T. J. Osborn. 2003. "The Role of the Oceans in Climate." *International Journal of Climatology* 23 (10): 1127–1159.

Blasiak, R., J. B. Jouffray, C. C. Wabnitz, E. Sundström, and H. Österblom. 2018. "Corporate Control and Global Governance of Marine Genetic Resources." *Science Advances* 4 (6).

Borrelle, Stephanie, Chelsea Rochman, Max Liboiron, Alexander Bond, Amy Lusher, Hillary Bradshaw, and Jennifer Provencher. 2017. "Opinion: Why We Need an International Agreement on Marine Plastic Pollution." *PNAS*, September 19. https://www.pnas.org/content/114/38/9994.

Borunda, Alejandra. 2019. "Ocean Acidification, Explained." *National Geographic*, August 7. https://www.nationalgeographic.com/environment/oceans/critical-issues-ocean-acidification/.

Brooks, Cassandra. 2013. "Competing Values on the Antarctic High Seas: CCAMLR and the Challenge of Marine-protected Areas." *The Polar Journal* 3 (2): 277–300.

Cai, J., H. Huang, and P. Leung. 2019. *Understanding and Measuring the Contribution of Aquaculture and Fisheries to Gross Domestic Product (GDP)*. Rome: Food and Agriculture Organisation (FAO).

Carbon Market Institute. 2021. *COP26 Glasgow Key Takeaways*. Carbon Market Institute.

CBD. 2022. "Aichi Target 11," Convention on Biological Diversity. Accessed September 07, 2022. https://www.cbd.int/aichi-targets/target/11.

CBD. 2022b. *COP15: NATIONS ADOPT FOUR GOALS, 23 TARGETS FOR 2030 IN LANDMARK UN BIODIVERSITY AGREEMENT*. 19 December. Accessed December 2022, 2022. https://www.cbd.int/article/cop15-cbd-press-release-final-19dec2022.

CBD. 2021. *FIRST DRAFT OF THE POST-2020 GLOBAL BIODIVERSITY FRAMEWORK*. Convention of Biological Diversity.

CCAMLR. 2020. "Achievements and Challenges," Commission for the Conservation of Antarctic Marine Living Resources. Accessed July 07, 2020. https://www.ccamlr.org/en/organisation/key-challenges-and-achievements.

Cecco, Leyland. 2021. "'Heat Dome' Probably Killed 1 Bn Marine Animals on Canada Coast, Experts Say," *The Guardian*, July 8. https://www.theguardian.com/environment/2021/jul/08/heat-dome-canada-pacific-northwest-animal-deaths.

Chaturvedi, Vaibhav. 2021. *Peaking and Net-Zero for India's Energy Sector CO_2 Emissions An Analytical Exposition*. New Delhi: Council on Energy, Environment and Water (CEEW).

Cheng, Lijing, John Abraham, Zeke Hausfather, and Kevin E. Trenberth. 2019. "How Fast Are the Oceans Warming?" *Science* 363 (6423): 128–129. https://doi.org/10.1126/science.aav7619.

Cheung, William W. L., Jorn Bruggeman, and Momme Butenschön. 2018. "Projected Changes in Global and National Potential Marine Fisheries Catch under Climate Change Scenarios in the Twenty-first Century." In *Impacts of Climate Change on Fisheries and Aquaculture. Synthesis of Current Knowledge, Adaptation and Mitigation Options*, edited by Manuel Barange, Tarûb Bahr, Malcolm C. M. Beveridge, Kevern L. Cochrane, Simon Funge-Smith, and Florence Poulain. Rome: Food and Agriculture Organization.

Chu, Jennifer. 2017. "Rising Temperatures Are Curbing Ocean's Capacity to Store Carbon." *MIT News*, July 6. http://news.mit.edu/2017/rising-temperatures-are-curbing-ocean-capacity-store-carbon-0706.

Chu, Jennifer. 2015. "Ocean Acidification May Cause Dramatic Changes to Phytoplankton." *MIT News*, 20 July. https://news.mit.edu/2015/ocean-acidification-phytoplankton-0720.

Commonwealth Secretariat. 2022. *Action Group on Sustainable Blue Economy*. https://bluecharter.thecommonwealth.org/action-groups/blue-economy/.

Dauvergne, Peter. 2018. "Why Is Global Governance of Plastic Failing in the Oceans?" *Global Environmental Change* 51: 22–31.

DeVries, T., M. Holzer, and F. Primeau. 2017. "Recent Increase in Oceanic Carbon Uptake Driven by Weaker Upper-ocean Overturning." *Nature* 542: 215–218.

Dieng, H. B., A. Cazenave, B. Meyssignac, K. von Schuckmann, and H. Palanisamy. 2017. "Sea and Land Surface Temperatures, Ocean Heat Content, Earth's Energy Imbalance and Net Radiative Forcing over the Recent Years." *International Journal of Climatology* 37 (S1): 218–229.

Doney, Scott C., Victoria J. Fabry, Richard A. Feely, and Joan A. Kleypas. 2009. "Ocean Acidification: The Other CO_2 Problem." *Annual Review of Marine Science* 1: 169–192.

Economist Impact. 2021. "COP26: Ocean Action Is Climate Action." *Economist Impact*, November 17. https://ocean.economist.com/governance/articles/untitled-cop26-ocean-action-is-climate-action.

Ehlin, Ulf. 1981. "Chapter 2: Hydrology of the Baltic Sea." *Elsevier Oceanography Series* 123–134.

Elmgren, Ragnar, Thorsten Blenckner, and Agneta Andersson. 2015. "Baltic Sea Management: Successes and Failures." *AMBIO* 44: 335–344.

European Commission. 2022. "EU Helps Launch Negotiations on Landmark Global Agreement on Plastic Pollution," European Comission. https://ec.europa.eu/commission/presscorner/detail/en/ip_22_1466.

FAO. 2016. *The State of World Fisheries and Aquaculture: Contributing to Food Security*. Rome: Food Agriculture Organisation.

———. 2018a. *The State of World Fisheries and Aquaculture*. Rome: Food and Agriculture Organization.

———. 2018b. "Is the Planet Approaching "Peak Fish"? Not So Fast, Study Says." Food and Agriculture Organization, July 9, 2018. http://www.fao.org/news/story/en/item/1144274/icode/.

———. 2020a. *The State of World Fisheries and Aquaculture 2020. Sustainability in Action*. Rome: Food and Agriculture Organization.

———. 2020b. "Agreement on Port State Measures (PSMA)," Food and Agriculture Organization. http://www.fao.org/port-state-measures/en/#:~:text=The%20Agreement%20on%20Port%20State,ports%20and%20landing%20their%20catches.

FICCI. 2017. *Blue Economy Vision 2025: Harnessing Business Potential for India Inc and International Partners*. New Delhi: Federation of Indian Chambers of Commerce & Industry.

Folami, Taoheed Olalekan . 2017. "Towards an Integrated Ocean Governance Regime and Implementation of the Sustainable Development Goal 14 in Nigeria." Dissertation. World Maritime University: Malmo, Sweden.

Freestone, David. 2018. "The Limits of Sectoral and Regional Efforts to Designate High Seas Marine Protected Areas." *AJIL Unbound* 112: 129–133.

Gallucci, Maria. 2018. "At Last, the Shipping Industry Begins Cleaning Up Its Dirty Fuels," *Yale Environment 360*, June 28. https://e360.yale.edu/features/at-last-the-shipping-industry-begins-cleaning-up-its-dirty-fuels.

GEF. 2019. "Areas Beyond National Jurisdiction," Global Environment Facility. Accessed Aug 19, 2019. https://www.thegef.org/topics/areas-beyond-national-jurisdiction.

Geoengineering Monitor. 2020. "High-risk Geoengineering Projects Are Proceeding in Violation of UN Moratoria," *Geoengineering Monitor*. Accessed July 2020. http://www.geoengineeringmonitor.org/2020/06/geoengineering-threatens-oceans/.

GESAMP. 2019. *High Level Review of a Wide Range of Proposed Marine Geoengineering Techniques*. London: International Maritime Organization.

Ghosh, Arunabha. 2011. "Seeking Coherence in Complexity? The Governance of Energy by Trade and Investment Institutions." Global Policy 2 (S1): 106–119.

Ghosh, Arunabha. 2019. "Governing Uncertainity in Geoengineering." *Business Standard*, April 23. https://www.business-standard.com/article/opinion/governing-uncertainty-in-geoengineering-119042300023_1.html.

Ghosh, Arunabha, Shalu Agrawal, Poulami Choudhury, Kanika Chawla, Anjali Jaiswal, Meredith Connolly, Deol, Bhaskar, and Nehmat Kaur. 2015. *Clean Energy Powers Local Job Growth in India*. New Delhi: Council on Energy, Environment and Water-National Resources Defence Council.

Ghosh, Arunabha et al. 2020. *Jobs, Growth and Sustainability: A New Social Contract for India's Recovery*. New Delhi: Council on Energy, Environment and Water-National Institute of Public Finance and Policy (CEEW-NIPFP).

Global Tuna Alliance. 2020. "Pacifical Partners with Global Tuna Alliance." Accessed June 2021. https://www.globaltunaalliance.com/general/pacifical-partners-with-global-tuna-alliance/.

Goswami, Urmi. 2020. "India, Norway Pledge to Address Issue of Marine Plastic Litter, Microplastics." *Economic Times*, February 17. https://economictimes.indiatimes.com/news/politics-and-nation/india-norway-pledge-to-address-issue-of-marine-plastic-litter-microplastics/articleshow/74170067.cms?utm_source=contentofinterest&utm_medium=text&utm_campaign=cppst.

Gottlieb, Hiroko Muraki. 2021. *Filling the Gaps in the Global Governance of Marine Plastic Pollution*. International Union of the Conservation of Nature (IUCN).

Haas, Bianca, Mary Mackay, Camilla Novaglio, Liam Fullbrook, Michael Murunga, Carla Sbrocchi, Jan McDonald, et al. 2021. "The Future of Ocean Governance." *Reviews in Fish Biology and Fisheries* 32: 253–270.

Harris, Paul. 2019. *Climate Change and Ocean Governance: Politics and Policy for Threatened Seas*. Cambridge: Cambridge University Press.

Heffernan, Olive. 2018. "How to Save the High Seas," *Nature*, May 9. https://www.nature.com/articles/d41586-018-05079-z.

HELCOM. 2021. *Outcome of the 42nd Meeting of the Baltic Marine Environment Protection Commission (HELCOM 42-2021)*. March 17. Accessed September 20, 2022. https://portal.helcom.fi/meetings/HELCOM%2042-2021-746/MeetingDocuments/Outcome%20of%20HELCOM%2042-2021.pdf.

Hilborn, Ray, and Daniel Ovando. 2016. "Reflections on the Success of Traditional Fisheries Management." *ICES Journal of Marine Science* 71 (5): 1040–1046.

Hindley, Hannah. 2021. "Blue Sparks Light up the Eastern Tropical Pacific at COP26." Accessed March 14, 2022. https://marine-conservation.org/on-the-tide/blue-sparks-light-up-the-eastern-tropical-pacific-at-cop26/.

Hoegh-Guldberg, Ove, Ken Caldeira, Thierry Chopin, Steve Gaines, Peter Haugan et al. 2019. *The Ocean as a Solution to Climate Change Five Opportunities for Action*. Washington, DC: World Resources Institute.

IEA. 2020. "IEA Energy Atlas," International Energy Agency. Accessed April 19, 2021. http://energyatlas.iea.org/#!/tellmap/1378539487.

IMO. 2014. *Reduction of GHG Emissions from Ships. Third IMO GHG Study 2014 – Final Report*. London: International Maritime Organization.

———. 2020. "IMO 2020 Sulphur Limit Implementation – Carriage Ban Enters into Force," International Maritime Organization. Accessed July 07, 2020. http://www.imo.org/en/MediaCentre/PressBriefings/Pages/03-1-March-carriage-ban-.aspx.

Ingold, Tim. 2008. "Bindings against Boundaries: Entanglements of Life in an Open World." *Environment and Planning* 40 (8): 1796–1810.

IPCC. 2013. "Summary for Policymakers." In *Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge, United Kingdom and New York, NY, USA.: Cambridge University Press.

———. 2014. "The Ocean." In *Climate Change 2014 – Impacts, Adaptation and Vulnerability: Part B: Regional Aspects: Working Group II Contribution to the IPCC Fifth Assessment Report*. Cambridge: Cambridge University Press, 1655–1731.

———. 2019a. *Special Report on the Ocean and Cryosphere in a Changing Climate*. Intergovernmental Panel on Climate Change.

———. 2019b. "Summary for Policymakers." In *Ocean and Cryosphere in a Changing Climate*, edited by H. -O. Pörtner, D. C. Roberts, V. Masson-Delmotte, P. Zhai, M. Tignor, E. Poloczanska, K. Mintenbeck et al. Intergovernmental Panel on Climate Change.

———. 2021. "Summary for Policymakers." In *Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*, edited by V. Masson-Delmotte, P. Zhai, A. Pirani, S. L. Connors, C. Péan, S. Berger, N. Caud et al. Cambridge: Cambridge University Press.

IUCN. 2018. *Marine Plastic Pollution*. International Union for Conservation of Nature: Gland, Switzerland.

Jensen, Daniel. 2020. "Patching the Gaps of ABNJ Governance," *FarFish*, Nov 3. https://www.farfish.eu/2020/11/03/patching-the-gaps-of-abnj-governance/.

Johnson, David, Carole Martinez, Ole Vestergaard, Dominique Duval-Diop, Marie Romani, Martha McConnel, Craig Beatty et al. 2014. "Building the Region Perspectives: Platform for Success." *Aquatic Conservation: Marine and Freshwater Ecosystems* 24 (S2): 75–93.

Jolliffe, J., C. Jolly, and B. Stevens. 2021. *Blueprint for Improved Measurement of the International Ocean Economy: An Exploration of Satellite Accounting for Ocean Economic Activity*. OECD Science, Technology and Industry Working Papers. Paris: Organisation for Economic Co-operation and Development.

Kao, Shih-Ming, Nathaniel Pearre, and Jeremy Firestone. 2012. "Adoption of the Arctic Search and Rescue Agreement: A Shift of the Arctic Regime Toward a Hard Law Basis?" *Marine Policy* 36 (3): 832–838.

Keohane, Robert O, and David G. Victor. 2010. "The Regime Complex for Climate Change." *American Political Science Association* 7-23.

Kituyi, Mukhisa, and Peter Thomson. 2018. "90% of Fish Stocks Are Used Up – Fisheries Subsidies Must Stop," UNCTAD, 13 July. https://unctad.org/en/pages/newsdetails.aspx?OriginalVersionID=1812#:~:text=It%20is%20sobering%20to%20consider,subsidies%20play%20a%20big%20role.

Kock, Karl-Hermann, ed. 2000. *Understanding CCAMLR's Approach to Management*. Commission for the Conservation of Antarctic Marine Living Resources. https://www.ccamlr.org/en/document/publications/understanding-ccamlr%E2%80%99s-approach-management.

Lam, Vicky, William Cheung, Gabriel Reygondeau, and Rashid Sumaila. 2016. "Projected Change in Global Fisheries Revenues under Climate Change." *Scientific Reports* 6 (32607).

Levitt, Daniel, and Niko Kommenda. 2018. "Is Climate Change Making Hurricanes Worse?" *The Guardian*, October 10. https://www.theguardian.com/weather/ng-interactive/2018/sep/11/atlantic-hurricanes-are-storms-getting-worse.

Long, Ronan. 2019. "Restoring Marine Environmental Damage: Can the Costa Rica v Nicaragua Compensation Case Influence the BBNJ Negotiations?" *Review of European, Comparative & International Environmental Law* 28 (3): 244–257.

Marine Conversation Institute. 2020a. "Global Marine Protection." Accessed April 22, 2021. https://mpatlas.org/zones/.

Marine Conservation Institute. 2020b. "Marine Protection Glossary." Accessed April 22, 2021. https://mpatlas.org/glossary.

Marine Conservation Society. 2021. "New Report Finds Bottom Trawling Taking Place in 98% of UK's Offshore Marine Protected Areas." Accessed April 22, 2021. https://www.mcsuk.org/news/marine-unprotected-areas.

Martin, Alex. 2018. *Lessons Learned from the Nairobi Convention (2014)*. International Waters Learning Exchange & Resource Network. ." Accessed April 22, 2021. https://iwlearn.net/resolveuid/007182b2-70f3-4143-bb2a-48d48fec04ab.

McCauley, Douglas, Kristian Teleki, and Gloria Fluxà Thienemann. 2020. "8 Ways to Rebuild a Stronger Ocean Economy after COVID-19," World Economic Forum, May 12. https://www.weforum.org/agenda/2020/05/how-to-build-a-bluer-ocean-economy-after-cobid-19

Miles, Tom. 2018. "The Level of Carbon Dioxide in the Atmosphere Has Hit a Record High, According to the UN," World Economic Forum, Nov 23. https://www.weforum.org/agenda/2018/11/global-carbon-dioxide-levels-hit-a-new-record-in-2017/.

Najam, Adil, Loli Christopoulou, and William Moomaw. 2004. "The Emergent "System" of Global Environmental Governance." *Global Environmental Politics* 4 (4): 23–35.

Nandi, Jayashree. 2022. "UN Environment Assembly Resolves to End Plastic Pollution." *The Hindustan Times*, March 4. https://www.hindustantimes.com/india-news/un-environment-assembly-resolves-to-end-plastic-pollution-101646333291154.html.

NEAFC and OSPAR. 2015. *The Process of Forming a Cooperative Mechanism Between NEAFC and OSPAR*. United Nations Environment Programme.

NEAFC. 2020. "Press Release from the 2020 Annual Meeting Of the North-East Atlantic Fisheries Commission." North-East Atlantic Fisheries Commission, November 16. https://www.neafc.org/system/files/AM-2020_Press-statement.v1_0.pdf.

NOAA. 2020a. “Ocean Acidification.” Accessed January 24, 2022. https://www.noaa.gov/education/resource-collections/ocean-coasts/ocean-acidification.

———. 2022. “Trends in Atmospheric Carbon Dioxide.” Accessed February 02, 2022. esrl.noaa.gov/gmd/ccgg/trends/.

Normile, Dennis. 2019. “Why Japan’s Exit from International Whaling Treaty May Actually Benefit Whales.” *Science*, January 10. https://www.sciencemag.org/news/2019/01/why-japan-s-exit-international-whaling-treaty-may-actually-benefit-whales.

Norwegian Government. 2021. “The Norwegian Development Programme to Combat Marine Litter and Microplastics.” Accessed August 08, 2021. https://www.regjeringen.no/contentassets/9ea1930ef21d4e8d96536ebef2e71147/marin_litter_202008.pdf.

OECD. 2016. *The Ocean Economy in 2030*. Paris: OECD Publishing.

———. 2020. “The SDG Financing Lab.” Accessed January 31, 2022. https://sdg-financing-lab.oecd.org/sdg-ranking?distribution=providers&finance=commitment&from=2019&oda=true&oof=true&other%20private%20flows=true&per=All&private%20grants=true&sdg=14&to=2019.

OSPAR. 2019. *Annual Report 2018–2019*. London: OSPAR Commission.

———. 2021. “Collective Arrangement.” Accessed June 07, 2021. https://www.ospar.org/about/international-cooperation/collective-arrangement.

Parker, Laura. 2020. “Plastic Trash Flowing into the Seas Will Nearly Triple by 2040 Without Drastic Action,” *National Geographic*, July 23. https://www.nationalgeographic.com/science/2020/07/plastic-trash-in-seas-will-nearly-triple-by-2040-if-nothing-done/.

Patrick, Stewart. 2021. “The ‘30x30’ Campaign to Save the Biosphere.” *World Politics Review*, April 12. https://www.worldpoliticsreview.com/articles/29565/the-30x30-campaign-to-save-the-planet-from-biodiversity-threats.

Pershing, Andrew J., Michael A. Alexander, Christina M. Hernandez, Lisa A. Kerr, A L Bris, K. E. Mills, J. A. Nye et al. 2015. “Slow Adaptation in the Face of Rapid Warming Leads to Collapse of the Gulf of Maine Cod Fishery.” *Science* 305 (6262): 809–812.

PNA. 2021. “About PNA.” Accessed June 17, 2021. https://www.pnatuna.com/content/about-pna.

Popovaa, Ekaterina, David Vousden, Warwick Sauer, Essam Mohammed, Valerie Allain, Nicola Downey-Breedt, Ruth Fletcher et al. 2019. “Ecological Connectivity Between the Areas Beyond National Jurisdiction and Coastal Waters: Safeguarding Interests of Coastal Communities in Developing Countries.” *Marine Policy* 104: 90–102.

Pratikto, Widi. 2016. *Expert Meeting in Preparation for HLPF 2017: Readying Institutions and Policies for Integrated Approaches to Implementation of the 2030 Agenda - Panel 7 – Integrated Actions for Oceans*. Presentation. Coral Triangle Initiative on Coral Reefs, Fisheries and Food Security.

Premti, Anila. 2018. “Conservation and Sustainable Use of Marine Biodiversity of Areas Beyond National Jurisdiction: Recent Legal Developments,” UNCTAD, October 29.

Pretlove , Bente, and Robert Blasiak. 2018. *Mapping Ocean Governance and Regulation*. UN Global Compact.

Protected Planet. 2022. *Discover the world’s protected areas*. December. Accessed December 22, 2022. https://www.protectedplanet.net/en.

Quéré, C. Le , R. Moriarty, R. M. Andrew, J. G. Canadell, S. Sitch, J. I. Korsbakken, P. Friedlingstein et al. 2015. “Global Carbon Budget 2015.” *Earth System Science Data* 7 (2): 349–396.

Roxy, M. K, C Gnanaseelan, Anant Parekh, Jasti S Chowdary, Shikha Singh, Aditi Modi, Rashmi Kakatkar, et al. 2020. “Indian Ocean Warming.” In *Assessment of Climate Change over the Indian Region*, by R Krishnan, J Sanjay, C Gnanaseelan, M Mujumdar, A Kulkarni and S. Chakraborty. Singapore: Springer.

Sabine, Christopher L., and Richard A. Feely. 2007. “The Oceanic Sink for Carbon Dioxide.” In *Greenhouse Gas Sinks*, edited by D. Reay, N. Hewitt, J. Grace, and K. Smith, 31–49. CABI Publishing: Seattle.

SACEP. 2018. *Towards Litter Free Indian Ocean: Summary of the Regional Marine Litter Action Plan for South Asian Seas Region*. Colombo: South Asia Co-operative Environment Programme.

Sallée, Jean-Baptiste. 2018. “Southern Ocean Warming.” *Oceanography* 31 (2): 52–62.

Sands, Philippe, Jacqueline Peel, and Adriana Fabra. 2012. *Principles of International Environmental Law*. Cambridge: Cambridge University Press.

Sarkki, Simo, E.V. Balian, Ulrich Heink, and Hans Keune. 2019. “Managing Science-policy Interfaces for Impact: Interactions Within the Environmental Governance Meshwork.” *Environmental Science & Policy* 113: 21–30.

Schlanger, Zoe. 2018. “If Shipping Were a Country, It Would be the World’s Sixth-biggest Greenhouse Gas Emitter,” World Economic Forum, 18 April. https://www.weforum.org/agenda/2018/04/if-shipping-were-a-country-it-would-be-the-world-s-sixth-biggest-greenhouse-gas-emitter.

Schmitt, Raymond W. 2018. “The Ocean’s Role in Climate.” *Oceanography* 31 (2): 32–40.

Serpong, Daniel Bruce, Samuel N. K. Quaatey, and Simon Kwadzogah Harvey. 2005. *The Economic and Social COntributions of Fisheries to Gross Domestic Product and Rural Development in Ghana*. Food and Agriculture Organization: Rome.

Shutler, Jamie, Peter Land, Jean-Francois Piolle, David Kevin Woolf, Lonneke Goddijn-Murphy, Frederic Paul, Fnny Girard-Ardhuin et al. 2016. "FluxEngine: A Flexible Processing System for Calculating Atmosphere-ocean Carbon Dioxide Gas Fluxes and Climatologies." *Journal of Atmospheric and Oceanic Technology* 33 (4): 741–756.

Singh, Gerald, Andrés M. Cisneros Montemayor, Wilf Swartz, William Cheung, J. Adam Guy, Tiff-Annie Kenny, Chris McOwen et al. 2018. "A Rapid Assessment of Co-benefits and Trade-offs Among Sustainable Development Goals." *Marine Policy* 93: 223–231.

Slany, Anja. 2020. *Multiple Disasters and Debt Sustainability in Small Island Developing States*. UNCTAD.

Smale, D. A., T. Wernberg, E. C. J Oliver, M. Thomsen et al. 2019. "Marine Heatwaves Threaten Global Biodiversity and the Provision of Ecosystem Services." *Nature Climate Change* 9: 306–312.

Sofiev, Mikhail, James Winebrake, Lasse Johansson, Edward Carr, Marje Prank, Joana Soares, Julius Vira et al. 2018. "Cleaner Fuels for Ships Provide Public Health Benefits with Climate Tradeoffs." *Nature Communications* 9: 406.

Sverdrup, Ulf, Alf Håkon Hoel, Hideaki Shiroyama, Michelle Voyer, Elana Wilson Rowe, and Wrenn Yennie-Lindgren. 2019. "Improving Future Ocean Governance – Governance of Global Goods in an Age of Global Shifts." T20 Japan.

Tarmizi, Mohd Khairul Tazril. 2010. *Institutional Framework for Ocean Governance: A Way Forward*. Malmo: World Maritime University.

Tsioumanis, Asterios. 2021. "The Rising Pressures on Ocean Governance," IISD. Accessed March 14, 2022. https://www.iisd.org/articles/rising-pressures-ocean-governance#:~:text=SDG%2014%20(life%20below%20water,holistic%20framework%20on%20ocean%20governance.

UN. 2021. *Intergovernmental Conference on an International Legally Binding Instrument under the United Nations Convention on the Law of the Sea on the Conservation and Sustainable Use of Marine Biological Diversity of Areas Beyond National Jurisdiction*. New York: United Nations General Assembly. https://www.undocs.org/en/A/75/L.96.

UNCTAD. 2017. *Fisheries Export and Economic Development of the Least Developed Countries: Bangladesh, Cambodia, The Comoros, Mozambique, Myanmar adn Uganda*. New York: UNCTAD.https://unctad.org/en/pages/newsdetails.aspx?OriginalVersionID=1905.

———. 2019. *Review of Maritime Transport*. Geneva: United Nations Conference on Trade and Development.

UNDP. 2017. "Institutitonal and Coordination Mechanisms: Guidance Note on Facilitating Integration and Coherence for SDG Implementation." https://sustainabledevelopment.un.org/index.php?page=view&type=400&nr=2478&menu=1515.

———. 2018. "What Works in Water and Ocean Governance."UNDP.

UNEP. 2015a. "Regional Seas Engagement in the Implementation and Monitoring of the Sustainable Development Goals (SDGs)." Istanbul: United Nations Environmental Programme.

———. 2015b. "UNEP Regional Seas Programme," *Biodiversity A¬–Z*. Accessed April 22, 2021. https://www.biodiversitya-z.org/content/unep-regional-seas-programme.

———. 2017. *Ocean Policies and Institutional Arrangements for Cross-sectoral Cooperation*. Nairobi: UN Environment Programme.

———. 2018. "Protecting Endangered Marine Life in the Northwest Pacific Region," UN Environment Programme, June 19. https://www.unep.org/news-and-stories/blogpost/protecting-endangered-marine-life-northwest-pacific-region.

———. 2018b. *Regional Seas Follow Up and Review of the Sustainable*. UNEP.

———. 2019a. "Protecting Coral Reefs, as We Move Towards a Blue Economy," United Nations, March 10. https://www.unenvironment.org/news-and-stories/story/protecting-coral-reefs-we-move-towards-blue-economy.

———. 2019b. *Proposal for a New Marine and Coastal Strategy of UN Environment Programme for 2020–2030*. United Nations Environment Assembly.

———. 2020. *Coraf Reefs*. Accessed July 2020. https://www.unenvironment.org/explore-topics/oceans-seas/what-we-do/working-regional-seas/coral-reefs.

———. 2020b. "Regional Seas Programme," UN Environment Programme. Accessed June 07, 2021. https://www.unep.org/explore-topics/oceans-seas/what-we-do/regional-seas-programme.

———. 2022. *COP15 ends with landmark biodiversity agreement*. 20 December. Accessed December 22, 2022. https://www.unep.org/news-and-stories/story/cop15-ends-landmark-biodiversity-agreement.

UNGA. 2017. *Resolution Adopted by the General Assembly on 6 July 2017. Our Ocean, Our Future: Call for Action*. New York: General Assembly, UN.

United Nations. 2004. *Oceans and the Law of the Sea: Report of the Secretary-General*. Geneva: United Nations.

———. 2017a. “Communities of Ocean Action – Sustainable Fisheries,” United Nations. Accessed July 2020. https://oceanconference.un.org/coa/SustainableFisheries.

———. 2019a. “Oceans and the Law of the Sea,” United Nations. Accessed Aug 19, 2019. https://www.un.org/depts/los/index.htm.

———. 2019b. *Global Sustainable Development Report 2019*. New York: United Nations Department of Economic and Social Affairs.

———. 2021. “The Toll of Illegal, Unreported and Unregulated Fishing,” United Nations, June 5. https://www.un.org/en/observances/end-illegal-fishing-day.

Vierros, Marjo, Autumn-Lynn Harrison, Matthew Sloat, Guillermo Ortuno Crespo, Jonathan Moore, Daniel Dunn, Yoshitaka Ota et al. 2020. “Considering Indigenous Peoples and Local Communities in Governance of the Global Ocean Commons.” *Marine Policy* 119. https://doi.org/10.1016/j.marpol.2020.104039.

Wahlen, Catherine Benson. 2019. “G20 Environment Ministers Adopt Framework to Tackle Marine Litter,” IISD, SDG Knowledge Hub, 27 June. https://sdg.iisd.org/news/g20-environment-ministers-adopt-framework-to-tackle-marine-litter/.

Wang, Shuang-Jing, Long Cao, and Na Li. 2014. “Responses of the Ocean Carbon Cycle to Climate Change: Results from an Earth System Climate Model Simulation.” *Advances in Climate Change Research* 5 (3): 123–130.

Warner. 2020. “Fishing for Success: Lessons in Pacific Regionalism,” *Dev Policy Blog*, August 12. https://devpolicy.org/fishing-for-success-lessons-in-pacific-regionalism-20200812/?print=print.

WCPFC. 2006. “Review Conference on the Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 Relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks.” Western and Central Pacific Fisheries Commission: New York.

———. 2020. *Scientific Committee Sixteenth Regular Session*. Western and Central Pacific Fisheries Commission.

WEF. 2019. *Ending Illegal Fishing: Data Policy and the Port State Measures Agreement*. Geneva: World Economic Forum.

Wenzel, Lauren, Neil Gilbert, Lyn Goldsworthy, Clive Tesar, Martha Mcconnell, and Melis Okter. 2016. “Polar Opposites? Marine Conservation Tools and Experiences in the Changing Arctic and Antarctic.” *Marine and Freshwater Ecosystems* 26: 61–84.

Wernberg, Thomas, Bayden D. Russell, Pippa J. Moore, Scott D. Ling, Daniel A. Smale, Alex Campbell, Melinda A. Colemang, et al. 2011. “Impacts of Climate Change in a Global Hotspot for Temperate Marine Biodiversity and Ocean Warming.” *Journal of Experimental Marine Biology and Ecology*: 7–16. https://doi.org/10.1016/j.jembe.2011.02.021.

Williams, David. 2016. “Plastic to Outweigh Fish in Oceans by 2050, Study Warns.” *Phys Org*, January 19. https://phys.org/news/2016-01-plastic-outweigh-fish-oceans.html.

World Ocean Initiative. 2019. “Ocean Offers Glimmer of Hope Amid COP25 Disappointment.” Accessed June 2020. https://ocean.economist.com/governance/articles/ocean-offers-glimmer-of-hope-amid-cop25-disappointment.

WWF. (2018). *Living Planet Report*. Retrieved from https://www.sciencedirect.com/science/article/pii/S0308597X21004851

WWF . 2021. “New UN Declaration Calls for the Development of a New Plastic Pollution Treaty,” World Wildlife Fund, June 1. https://wwf.panda.org/wwf_news/?2745966/New-UN-declaration-calls-for-the-development-of-a-new-plastic-pollution-treaty.

WWF and Sky Ocean Rescue. 2019. *Protecting Our Ocean: Europe’s Challenges to Meet the 2020 Deadlines*. World Wildlife Fund (WWF).

WWF. 2020a. “Coral Reefs,” World Wildlife Fund. Accessed July 2020. https://wwf.panda.org/our_work/oceans/coasts/coral_reefs/.

Yale Climate Connections. 2021. “Maritime Shipping Causes More Greenhouse Gases than Airlines,” *Yale Climate* Connections, August 2. https://yaleclimateconnections.org/2021/08/maritime-shipping-causes-more-greenhouse-gases-than-airlines/.

Young, Oran. 1999. *Governance in World Affairs*. London: Cornell University Press.

Acronyms

ABNJ	areas beyond national jurisdiction
AIMS	Australian Institute of Marine Science
AOSIS	Alliance of Small Island States
AR5	Fifth Assessment Report
AR6	Sixth Assessment Report
ATS	Antarctic Treaty System
BAU	business as usual
BBNJ	Biodiversity of Areas Beyond National Jurisdiction
BDC	Biological Diversity and Ecosystem Committee
Collective Arrangement	Collective Arrangement between competent international organisations on cooperation and coordination regarding selected areas in areas beyond national jurisdiction in the North-East Atlantic
CBD	Convention on Biological Diversity
CCAMLR	Convention of Conservation of Antarctic Marine Living Resources
CCAMLR'	Commission of Conservation of Antarctic Marine Living Resources
CLC	International Convention on Civil Liability for Oil Pollution Damage
CTC	Coral Triangle Centre
DSCC	Deep Sea Conservation Coalition
EDF	Environmental Defense Fund
EEZ	exclusive economic zone
FAO	Food and Agriculture Organization
GHG	greenhouse gas
GVA	global value added
HELCOM	Baltic Marine Environment Protection Commission
IATTC	Inter-American Tropical Tuna Commission
ICCAT	International Commission for the Conservation of Atlantic Tunas
ICES	International Council for the Exploration of the Sea
IMO	International Maritime Organization
INC	Intergovernmental Negotiating Committee
IOC	Intergovernmental Ocean Commission
IOI	International Ocean Institute
IORA	Indian Ocean Rim Association
IOTC	Indian Ocean Tuna Commission

IPCC	Intergovernmental Panel on Climate Change
ISA	International Seabed Authority
IUCN	International Union for Conservation of Nature
IUU	illegal, unreported, and unregulated
IWC	International Whaling Commission
LC/LP	London Convention/London Protocol
MARPOL	International Convention for Prevention of Marine Pollution for Ships
MPAs	marine protected areas
NAFO	Northwest Atlantic Fisheries Organization
Nauru Agreement	Concerning Cooperation in the Management of Fisheries of Common Interest
NDCs	nationally determined contributions
NDRC	Natural Resources Defense Council
NEAFC	North-East Atlantic Fisheries Commission
NOAA	National Oceanic and Atmospheric Administration
NOWPAP	North-west Pacific Action Plan
NPFC	North Pacific Fisheries Commission
OCIA	Ocean & Climate Initiatives Alliance
OCS	carbon storage space
OIF	ocean iron fertilisation
OSPAR Convention	Convention for the Protection of the Marine Environment of the North-East Atlantic
Palau Agreement	Palau Arrangement for the Management of the Purse Seine Fishery in the Western and Central Pacific
PAME	Protection of Arctic Marine Environment
PNA	Parties of Nauru Agreement
PERSGA	Programme for the Environment of the Red Sea and Gulf of Aden
PICES	North Pacific Marine Science Organization
POGO	Partnership for Observation of the Global Ocean
PPP	purchasing power parity
PSMA	Agreement on Port State Measures to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated Fishing
RFMOs	Regional Fisheries Management Organisations
RSP	Regional Seas Programme
RSCAPs	Regional Seas Convention and Action Plans
SACEP	South Asia Cooperative Environment Programme

SASAP	South Asian Seas Action Plan
SCOR	Scientific Committee on Oceanic Research
SDGs	Sustainable Development Goals
SEAFO	South East Atlantic Fisheries Organisation
SIDS	small island developing states
SRPFMO	South Pacific Regional Fisheries Management Organisation
SPREP	Secretariat of the Pacific Environment Programme
SROCC	Special Report on the Ocean and Cryosphere in a Changing Climate
SSCS	Sea Shepherd Conservation Society
SST	sea surface temperature
Tokelau Agreement	Tokelau Arrangement for the Management of the South Pacific Albacore Fishery
UNCLOS	United Nations Convention on the Law of the Sea
UNDP	United Nations Development Programme
UNEA	United Nations Environmental Assembly
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFCCC	United Nations Framework Convention on Climate Change
UNIDO	United Nations Industrial Development Organization
VDS	Vessel Day Scheme
WCP	Western and Central Pacific
WCPFC	Western and Central Pacific Fisheries Commission
WHOI	Woods Hole Oceanographic Institution
WOC	World Ocean Council
WWF	World Wildlife Fund for Nature

The authors

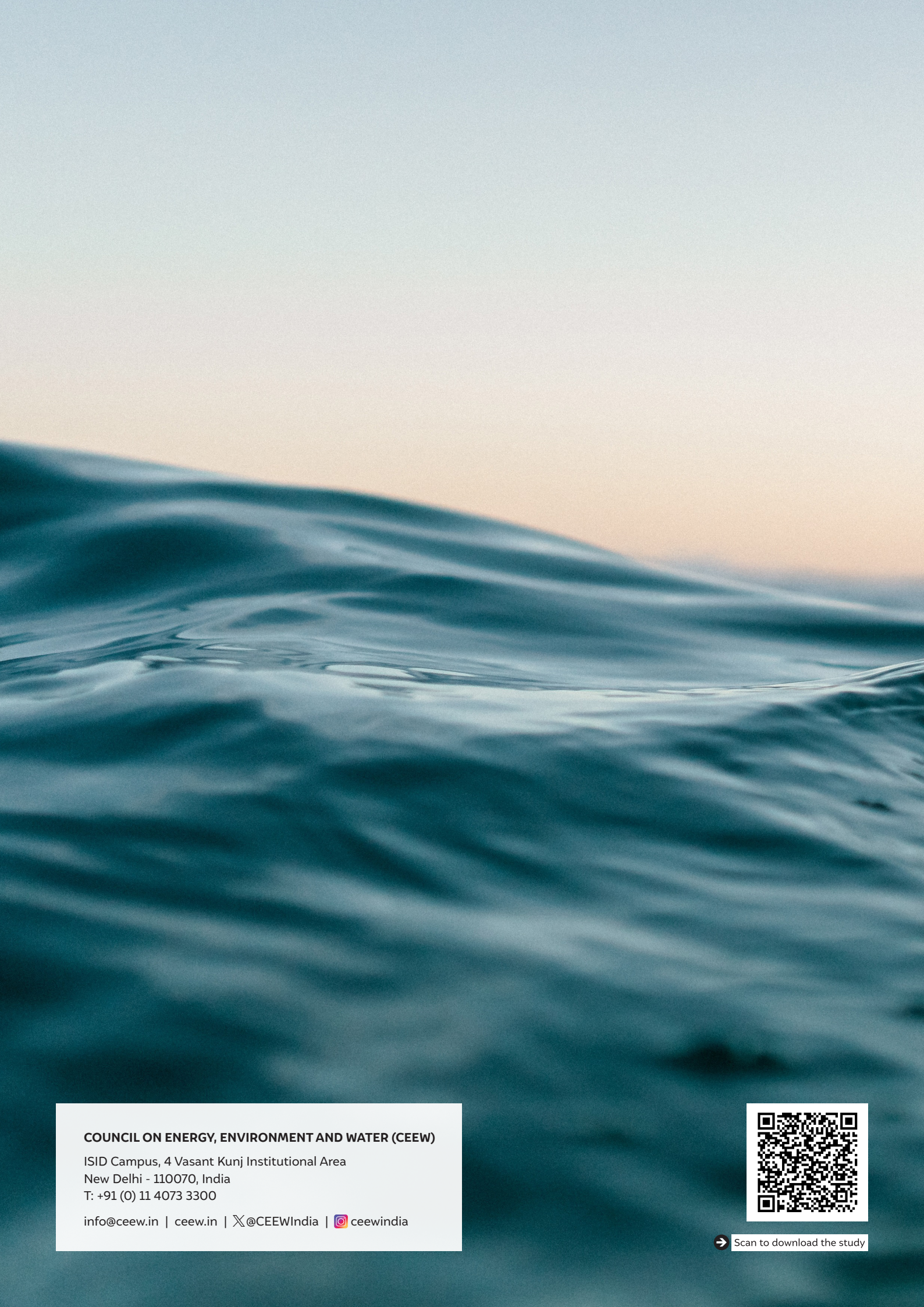
Nandini Harihar
nandini.harihar@ceew.in | 𝕏 @hariharnandini

Nandini Harihar is a Programme Associate and works with the CEO in the International Cooperation team. Her current research broadly covers the geopolitics and governance of the global commons. This includes climate risk, energy security, ocean governance, technology collaboration, multilateralism, and geoengineering. Her broader interests lie at the confluence of national and global environmental governance and domestic and foreign policy alliance in a changing geopolitical world.

Nandini holds an undergraduate degree in Meteorology and Oceanography from the University of East Anglia and a postgraduate degree in Environmental Technology and Global Environmental Change and Policy from Imperial College London.

Ankur Malyan
malyanankur@gmail.com | 𝕏 @ankur_malyan

Ankur was previously a Programme Associate at CEEW in the Low-Carbon Pathways team. His research work at CEEW encompassed developing a Global Change Analysis Model (GCAM) for Indian states to facilitate sub-national energy – climate policy research and adaptive decision-making; understanding energy system transformations and trade-offs in India under alternative net-zero pathways, and assessing the evolution of India's energy portfolio under different principle-driven carbon budgets. He also analysed carbon space consumption, stakeholders' perceptions of India's decarbonisation strategies, and low-carbon technologies such as carbon capture, utilisation, and storage.



COUNCIL ON ENERGY, ENVIRONMENT AND WATER (CEEW)

ISID Campus, 4 Vasant Kunj Institutional Area
New Delhi - 110070, India
T: +91 (0) 11 4073 3300

info@ceew.in | ceew.in | @CEEWIndia | ceewindia

Scan to download the study