Assessing Progress on Ocean and Climate Action: 2020-2021

A Report of the Roadmap to Oceans and Climate Action (ROCA) Initiative

ROCA
COP 26

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ROCA Leadership

UNESCO Intergovernmental Oceanographic Commission
Ocean Policy Research Institute, Sasakawa Peace Foundation
Oceano Azul Foundation

2020-2021 Progress Report Collaborating Organizations

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OA Alliance
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IOM UN Migration 70 Years
Ocean Policy Research Institute, Sasakawa Peace Foundation
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IMO International Maritime Organization
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Supported by the Ocean Policy Research Institute of the Sasakawa Peace Foundation, Japan

DEDICATION

To Biliana, a passionate, determined and infectious voice for the ocean, permeating the ocean community so the ocean has more and more voices – a wonderful legacy.

Dr. Carol Turley OBE, Head of International Office,
Plymouth Marine Laboratory

Climate change, biodiversity are matters of global concern and we all are the stewards of such unique global commons. Biliana, among her many achievements, is the one who has opened the door of formal negotiations among governments to the multitude of stakeholders concerned – we are all concerned in fact – by such issues. She has thus proven to be a champion of intra- and inter-generational equity. We all owe Biliana a big debt, thank you Biliana.

Dr. Salvatore Arico, Head of the Ocean Science Section
at the Intergovernmental Oceanographic Commission of UNESCO

For Biliana, whose incredible dedication and prodigious work for healthy oceans and climate continue to influence and inspire ocean and coastal colleagues all over the world. We will be forever grateful.

Mr. Richard F. Delaney,
President & C.E.O., Center for Coastal Studies

Biliana leaves us an exemplary legacy, especially due to her exceptional character, a powerful combination of energy, tenacity, force, conviction, benevolence, total openness to others, and an incomparable joy of living. The world ocean owes her a lot.

Mr. Philippe Vallette, Representative for
International Affairs (former Director General), Nausicaá,
Centre National de la Mer, France, and Vice President, World Ocean Network

To Biliana, who led with great intellectual power and foresight, brought people together with her passion and compassion, for the sustainability of mother ocean and the lives that depend on it, thank you.

Dr. Miko Maekawa, Senior Research Fellow,
Ocean Policy Research Institute of the Sasakawa Peace Foundation

Biliana will not be forgotten. Every country, civil society organization that calls itself an Ocean Champion has benefited from her passion, her capacity, intelligence, networking, and organization skills in pushing the ocean higher in the international agenda. The World Summit on Sustainable Development in 2002, together with the Climate COP's, since Copenhagen in 2009, were remarkable examples of her achievements for that purpose.

Tiago Pitta e Cunha, Chief Executive Officer,
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Oceans Action Day at COP25 High-Level Speakers (© IISD)

Foreword

This final volume of the ***Assessing Progress on Ocean and Climate Action*** report, like the earlier issues, is a multi-organizational effort involving old and new partners with one common objective, which is to bolster the recognition of the importance of oceans in the climate change process and ambition under the Paris Agreement on Climate Change. A compilation of evidence for this growing recognition from various sectoral and stakeholder initiatives in science, policy development, financing and other cross-cutting efforts makes this report a must-read for Party negotiators and non-Party stakeholder representatives at the 26th Conference of the Parties (COP) to the United Nations Framework Convention on Climate Change (UNFCCC). As well, young policy entrepreneurs who are just finding their feet in this challenging but exciting business of climate negotiations may find inspiration from the encouraging developments covered by this report.

For the ocean and climate community, 2020 and 2021 are important years in the quest to break down barriers to the official recognition that the ocean should be accorded its proper place in the development of solutions to climate change and its adverse impacts. In 2020, the landmark COP25 decision to convene the Subsidiary Body for Scientific and Technological Advice (SBSTA) Ocean and Climate Change Dialogue to consider how to strengthen mitigation and adaptation action resulted in a recognition for governments to take the world's oceans more strongly into account while considering mitigation and adaptation to the impacts of climate change. In the same year, the Marrakech Partnership for Global Climate Action held Race to Zero dialogues to reflect on progress made by various sectors, including the ocean and coastal zones, in transitioning to a zero-carbon future. Both years were fraught with euphoria emanating from the successes of both streams of work under the UNFCCC and uncertainties brought about by the current COVID-19 global pandemic. In 2020, the ocean and climate community also lost a staunch advocate for the ocean with the passing of Dr. Biliana Cicin-Sain. And as we come to the end of 2021, we are also marking the final year of the Roadmap to Oceans and Climate Action (ROCA) Initiative, which has been guiding the ocean and climate community in advancing the oceans and climate agenda especially in the UNFCCC. Yet the ocean and climate community is forging on with no less energy and ambition. These milestones are critical markers for a rapidly changing world in need of a fresh flow of innovative and transformative approaches to long-standing as well as emerging problems.

This series of reports, ***Assessing Progress on Ocean and Climate Action,*** are the only publications of their kind. Since 2016 they have provided technical insight and information on each of the six areas addressed by the ROCA initiative. Among other things, the reports highlight major developments in ocean and climate action and scan the horizon for new and emerging areas that need to be considered if we are to manage ocean-based issues and their solutions towards the achievement of the Paris Agreement targets. We hope this final volume, for dissemination at COP26, will have an even greater impact than previous volumes, making a valuable contribution in informing Party and non-Party stakeholders as they strive to meet the challenges and raise greater ambition for ocean and climate action.

Miriam C. Balgos, Global Ocean Forum

Miko Maekawa, Ocean Policy Research Institute of the Sasakawa Peace Foundation

Tiago Pitta e Cunha, Oceano Azul Foundation

Julian Barbiere, Intergovernmental Oceanographic Commission of UNESCO

EXECUTIVE SUMMARY

Following in the footsteps of three previous Roadmap to Oceans and Climate Action (ROCA) reports, the 2020-2021 report is the final ROCA report in the series. The report provides an update on recent initiatives, while taking stock of the progress in implementing the ocean and climate agenda at UNFCCC, in other global policy processes, as well as regionally and nationally. The report also seeks to make recommendations for future action where possible.

Since the last ROCA report in 2019, the COVID-19 pandemic has caused profound suffering and loss, disrupted lives, livelihoods and economies, and redefined normalcy. It has also caused the cancellation of ocean and climate meetings, slowed down policy processes, impacted funding levels and slowed down scientific research. At the same time, COVID-19 has been a catalyst for some important innovations that have allowed the ocean-climate work to carry on. There is a growing sentiment among many that COVID-19 provides an opportunity to build back smarter, in a way that allows us to re-imagine how to improve our economies and our relationship with the environment, including the ocean.

The need for action is urgent. According to the Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report, published in 2021, marine heatwaves have become more frequent over the 20th century, and are also projected to increase around the globe over the 21st century. This warming is likely to further decrease oxygen concentrations, with deoxygenation projected to last for thousands of years. It is also virtually certain that global mean sea level will continue to rise for centuries to millennia due to continuing deep ocean heat uptake and mass loss from ice sheets. Ocean acidification has increased globally over the past four decades, and in the open ocean, acidification, changes in sea ice, and deoxygenation are detectable in many areas.

Since 2016, the ROCA reports present a disturbing picture of the level of environmental deterioration in the global oceans due to climate change impacts and the increasing demands and pressures for ever more innovative modes of adaptation and mitigation. There is no doubt that around the world we are seeing real and tangible impacts of climate change on a scale that has not been experienced before. These impacts are causing increasing loss of lives and livelihoods, as well as inflicting billions of dollars of damage to buildings, harbours, and infrastructure in coastal zones, and rendering large areas of populated coastal regions potentially uninhabitable.

At the same time, there is much progress to report on the ocean-climate nexus. Notably, the convening of the UNFCCC SBSTA Ocean and Climate Change Dialogue in late 2020 provided a vital space for learning, action and discussion of synergies, as well as for planning a way forward towards strengthening ocean and climate adaptation and mitigation action under the UNFCCC, across the UN, and at national levels. There seems to be a growing understanding that "ocean action is climate action", as stated in the informal report of the SBSTA Ocean and Climate Change Dialogue. In addition, the Marrakech Partnership for Global Climate Action (MP-GCA) held the Race to Zero dialogues to reflect on progress made by various sectors, including those operating in the ocean and coastal zones, in transitioning to a zero-carbon future. The Friends of the Ocean and Climate, with the support of Ocean Conservancy, organized the Ocean-Climate Ambition Summit, a major international climate event held in January 2021. The Ocean-Climate Platform has worked towards an improved understanding of ocean-climate-biodiversity interactions and a better integration of the ocean in climate negotiations, and has launched the Sea'ties Initiative to facilitate coastal cities' adaptation to sea level rise and enhance global resilience to climate change.

An Ocean Action Day was held virtually in 2020, while an in-person high-level event is planned for COP 26 to bring together multiple stakeholders. The aim of the Ocean Action Day at COP 26 is to focus on scaling-up ocean-based climate solutions to deliver a resilient, net zero, equitable, and nature-positive future. Additionally, two important declarations are planned for COP 26. The Ocean for Climate Declaration aims to support a strong political outcome at COP26 on the intrinsic connection between the ocean and the climate. The drafting of the third Because the Ocean Declaration has included some sixteen UNFCCC Parties, and will be launched at a high-level event on the first day of COP 26.

Outside of the UNFCCC, the General Assembly has drawn the link between oceans and climate change in various resolutions. The second World Ocean Assessment, which was launched in early 2021, identifies climate change as one of five main drivers of change in the ocean. The Informal Consultative Process (ICP) focused in 2021 on the topic of sea-level rise, highlighting the urgency of impacts and the need for action. The United Nations Decade of Ocean Science for Sustainable Development, launched in 2021, also places emphasis on supporting science for ocean-climate action in the 2021-2030 timeframe.

Regional level initiatives focusing on ocean-climate linkages include the Pacific Rim Ocean-Climate Action Partnership (PROCAP), and the United Nations Environment Programme/ Mediterranean Action Plan (UNEP/MAP)-Barcelona convention's Regional Climate Change Adaptation Framework for Marine and Coastal Areas. In addition, the Regional Organization for the conservation of the environment in the Red Sea and Gulf of Aden (PERSGA) undertakes ecosystem-based adaptation and mitigation on key marine and coastal ecosystems. The European Union has incorporated ocean and climate considerations into a number of policy initiatives, such as the European Green Deal, the European Climate Law, and the Biodiversity Strategy for 2030.

Regions such as the Pacific have advocated for sea-level rise response to include international law as part of the tools of adaptation and response measures. International law would need to recognize the right of States impacted by sea level rise to preserve existing maritime zone boundaries established in accordance with international law. Without this legal recognition, it is possible for an island State to lose its legal entitlement to its Exclusive Economic Zone (EEZ) and possibly continental shelf. If the rising seas inundate an island further to a low-tide elevation, it would not be entitled to any maritime zone, including a territorial sea, under international law. In a worst case scenario, the legal question is whether an island could actually lose statehood.

On the national level, an increasing number of countries committing to advancing ocean-climate solutions in their Nationally Determined Contributions (NDCs), including nature-based solutions for climate change mitigation and adaptation, and blue carbon as part of mitigation strategies. This increased ambition is evident in the updated NDCs. Marine, and in particular coastal, ecosystems and their vulnerability are also widely incorporated into National Adaptation Plans (NAPs), although these plans often lack specificity. The latest National Ocean Policies (NOPs), such as Fiji's NOP take stock of climate change policies and issues. There is an increasing recognition, internationally and nationally, that protecting and restoring blue carbon ecosystems not only contributes to climate change mitigation and adaptation, but also to achieving several national targets in relation to the Sustainable Development Goals (SDGs).

Many knowledge gaps exist in ocean science, particularly concerning the changes occurring, which are rarely monitored in deep water or remote locations, and the consequences of those changes for ocean ecosystems and human communities. There are even more fundamental gaps in understanding deep-sea processes (including climate change impacts on deep-sea living marine resources and habitats) and coastal processes, bentho-pelagic coupling and biogeochemical cycles and feedbacks needed to groundtruth earth system models and accurately project environmental change (e.g., for deoxygenation, ocean acidification, increasing seawater temperature) under different emissions scenarios. Due to the hyper-connectivity of ocean ecosystems, there is a need to scale-up our research to ocean-basin scales over longer time scales to understand the impacts and design appropriate adaptation and mitigation strategies, as well as early warning models and indicators. Given the complexity of the challenges, research will need to include different stakeholders and experts from different disciplines, including social sciences.

Maritime transport is moving towards reducing carbon intensity per transport work by at least 40% by 2030, following adoption by Member States of the Initial International Maritime Organization (IMO) Strategy on reduction of greenhouse gas (GHG) emissions from ships adopted in 2018. Since the adoption of the Initial Strategy, IMO has been actively working on transposing the strategically defined levels of ambition to mandatory requirements that apply to individual ships to ensure that the levels of ambition are effectively achieved in line with the agreed timelines. This is important to ensure that IMO's commitments do not just remain aspirational targets but lay down a binding regulatory framework that applies to the world fleet and is enforced globally.

Ocean-based renewable energy includes offshore wind, tidal energy, salinity gradient energy, ocean thermal energy conversion and offshore floating photovoltaic. While offshore wind power is a relatively mature technology and already commercialized, other ocean-based renewables are emerging technologies with varying degrees of maturity. Most are still in the research, development and demonstration (RD&D) phases. As of 2020, the capacity of offshore wind energy worldwide reached approximately 34.4 gigawatts with 70% of this capacity generated in Europe. Massive growth in offshore wind, floating photovoltaics, and other forms of ocean renewable energy is foreseen in the coming decades.

In regards to adaptation, necessary actions to address the ocean-climate linkage include: increased ocean-related adaptation, including through creation of a comprehensive network of "climate smart" marine protected areas designed to safeguard ocean resilience, coral reef protection, and integrated coastal zone management; increased funding for ocean-related adaptation; increased awareness and highlighting of the linkage; and stronger recognition and inclusion of coastal and marine ecosystems in landscape approaches. Marine spatial planning (MSP) is not yet widely seen as a part of climate adaptation strategies, but provides opportunities for integrating climate change into ocean planning processes, which consider and attempt to reconcile multiple human demands on marine spaces.

The blue economy has come to signify international interest in the growth of ocean-based economic development in a manner that is both environmentally sustainable and socially equitable. However, the meaning of these terms, and the manner in which they are applied, are still open to interpretation. There are numerous policies, strategies and initiatives supported by multilateral, bilateral and private sector actors working to transition into a low-carbon blue economy around the world. Some are already being implemented while others are just in the formative stages. Two of the most significant emerging factors in the low carbon blue economy are the dramatic increase in climate related finance being directed toward the blue economy, and the emergence of innovative approaches to climate change mitigation and adaptation. Although climate finance in the blue economy has increased significantly in recent years, much more will be required in the future. Going forward, there is a need to promote new financial instruments (such as blue bonds), provide technical assistance to governments, further engage the private sector, and set up "mini-grids" powered by solar photovoltaic panels and solar platforms.

Human mobility in the context of disasters, climate change and environmental degradation is multi-causal, and environmental drivers such as sea-level rise or ocean acidification cannot be disentangled from social, political, economic, and demographic factors. In 2020, it is estimated that 30.7 million people were internally displaced by disasters worldwide. Of those, 14 million were displaced in the context of floods and 14.6 million in the context of storms. Although not included under these figures, many more people are displaced in the context of slow-onset processes, including sea level rise, salinization, ocean acidification, loss of biodiversity and increasing temperatures. Despite some ongoing knowledge and data gaps, evidence of the potential impacts of climate change on human mobility has grown considerably, and the need for significant action is now widely recognized. Global efforts to address the links between human mobility and climate change have advanced considerably over the past decade. There is a need for international cooperation to increase the adaptive capacity of vulnerable people, and to manage human mobility with dignity in the face of a worsening climate crisis.

Ocean finance levels overall continue to show a vast gap between the needs identified and the funding provided. Nonetheless significant progress has been made since UNFCCC COP 21 not only in identifying financing needs, tools and opportunities, but also in describing the processes required to scale up ocean climate finance overall and to target it, in particular also to those most affected, such as Small Island Developing States (SIDS). Knowledge and research initiatives such as the High-Level Panel for a Sustainable Ocean Economy and the Friends of Ocean Action have shown that investment in ocean solutions can, at the same time, significantly contribute to address climate change. Much remains to be learned about how to unlock and enable private capital to help finance national and local adaptation priorities, and how to build the business case for adaptation. De-risking finance and using innovation to mobilise investment is key to efforts to scale up the amount of finance required, and to make sure that countries have continued access to resources even during periods of financial dislocation, such as during the COVID-19 pandemic. A comprehensive ocean finance architecture is needed that can deliver adequate financing that fully integrates ocean climate solutions for coastal zones and the high seas alike.

Capacity development integrating the ocean and climate change is being undertaken by different organizations in different contexts. Internationally, the Intergovernmental Oceanographic Commission (IOC) of UNESCO is playing a prominent role through their capacity development programmes, as well as the UN Decade of Ocean Science for Sustainable Development. Aquariums, science centres and museums also play an important role in educating and empowering youth and the general public. Innovative approaches to engage and educate the general public and youth include citizen science, virtual and augmented reality, living labs, sea festivals and open science days. Improving opportunities for ocean and climate social empowerment requires better access to comprehensive learning across all age groups and layers of society, including those with a limited access to the ocean.

Taken together, much has been achieved towards ocean and climate action but more still needs to be done. There is a need to raise ambition on ocean action, both globally and nationally. Commitments on finance and concrete ocean-climate action, including both adaptation and mitigation, are needed internationally. Better coordination on ocean-climate action is also required across UN fora and events, including between UNFCCC, Convention on Biological Diversity (CBD), IMO, Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR), the Biodiversity of Areas Beyond National Jurisdiction (BBNJ) process, the SDG 14 process, and the Our Ocean Conference. At national levels, increased ambition will include the integration of specific ocean solutions into NDCs, NAPs, and other national-level plans, further creating coherence in implementation of climate and ocean action.

With the ROCA Initiative coming to an end, a reflection meeting is being planned in the spring of 2022 to assess the extent to which and how the Initiative has accomplished its goals and draw lessons learned from its 5-year implementation. The information from this activity will inform the planning of a successor initiative for the oceans and climate community going forward. Priorities for the future include promoting the current trajectory set in motion by Parties and non-Party stakeholders, including the Ocean Pathway Partnership, Because the Ocean, among others, to pursue a proper recognition of the importance of the ocean in the climate change process and ambition under the Paris Agreement. Priorities also include exploring and exploiting the opportunities and pathways that may be available within the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) and cross-linkages among UN fora and other intergovernmental bodies such as the informal link between the IPBES and IPCC to advance focus on the ocean and climate nexus.

OceanImageBank_TobyMatthews

1. INTRODUCTION

1.1 Purpose of the Progress Report

This fourth and final report of the ROCA initiative takes stock of where we are, and where we would like to be in the future. The report follows in the footsteps of three previous reports that assessed progress on ocean and climate action (ROCA reports covering the periods of 2016-2017; 2018; and 2019), as well as Oceans Action Days held at UNFCCC COPs 22, 23, 24 and 25 and the virtual Oceans Action Day held in 2020 due to the COVID-19 pandemic. The final ROCA report also comes at a critical moment that aligns with the commencement of the United Nations Decade of Ocean Science for Sustainability (2021-2030).

Since 2016, when the ROCA initiative was first adopted, there has been a growing international recognition of the ocean as a fundamental part of the climate system. This has been demonstrated by an increasing focus on ocean issues at the UNFCCC (as demonstrated, for example, by the UNFCCC Ocean and Climate Change dialogue and the Special Report of the Intergovernmental Panel on Climate Change (IPCC) on the Ocean and Cryosphere in a Changing Climate); a growing number of reports and peer reviewed publications on the topic; events organized around the ocean-climate nexus at UNFCCC COPs and other international fora; and, importantly, growing evidence that the restoration and protection of ocean health is becoming part of national and global strategies to respond to climate change and its impacts. This report also demonstrates new and innovative efforts to raise public awareness and involve youth in the work on the ocean and climate.

Even so, the future needs and knowledge gaps are many. Better coordination between the ocean, biodiversity and climate conventions and processes is needed to rally countries and to promote ocean-climate ambition across other UN fora and events. Scientific research needs to be scaled up to ocean-basin scales over long time frames due to the hyper-connectivity of ocean ecosystems, and trans-disciplinary research that includes social sciences is needed to address complex problems relating to socio-ecological systems. More legal work is needed, too, including as part of sea-level rise responses where States could lose their legal entitlements to their EEZs and possibly continental shelf. And finally, ambition on ocean-climate action needs to be raised, with sufficient and predictable financing made available.

In 2021 we find ourselves in a place where we can celebrate real progress that has been made during the past years. At the same time, progress has been slowed by the COVID-19 pandemic, and even without such delays we still have a long way to go before the ocean and climate are truly integrated in adaptation and mitigation response measures, and in national and global policies. There is also still much work to be done to raise public awareness about the importance of the ocean for climate, for biodiversity, and as a life support system for the planet Earth. As such, we report in this document on progress made to date but also propose future ocean-climate actions that should be considered priorities in the coming years.

1.2 Progress on the ocean and climate nexus within the UNFCCC

Ocean and climate change dialogue to consider how to strengthen adaptation and mitigation action and ways forward

The ocean and climate change dialogue to consider how to strengthen adaptation and mitigation action was mandated at COP 25[1] and convened by the SBSTA Chair on 2 and 3 December 2020 during the UNFCCC Climate Dialogues 2020.[2]

In advance of the ocean dialogue, the SBSTA Chair provided an information note that summarized current ocean and climate change action under the Convention and the Paris Agreement, and within the wider UN system. Furthermore, the information note summarized the 47 submissions received by the UNFCCC Secretariat from Parties and non-Party stakeholders to inform the ocean dialogue, and proposed the approach for the event.[3]

The SBSTA Chair ensured that the ocean dialogue was inclusive and participatory, with inputs from both Parties and non-Party stakeholders, including those from academia, subnational authorities, NGOs and youth organizations.

The ocean dialogue offered a vital space to enhance and strengthen learning, action and synergies. It also served as a space to discuss options and ways forward at multiple levels to strengthen ocean and climate adaptation and mitigation action under the UNFCCC, across the UN, at nationals level with a particular focus on financial and other international **cross-cutting support for action.**

The SBSTA Chair provided an informal summary report[4] from the event with key messages from the dialogue

1 Decision 1/CP.25, paras. 31 and 33–34.
2 See https://unfccc.int/cd2020.
3 Available at https://unfccc.int/sites/default/files/resource/OD_InformationNote.pdf.
4 https://www.unfccc.int/sites/default/files/resource/SBSTA_Ocean_Dialogue_SummaryReport.pdf

that include the need for Parties to:

- Recognize the interconnectedness of the ocean, climate change and nature and strengthen understanding that ocean action is climate action and strong climate ambition is needed to protect the ocean and its ecosystems.
- Strengthen research and systematic observation of the ocean in parallel with strengthening scientific underpinning of action moving forward.
- Increase ambition that includes ocean action and integrate ocean-based solutions at national levels into NDCs, NAPs and other national processes.
- Strengthen the inclusion of ocean-related issues under the work of UNFCCC workstreams, constituted bodies and global stocktake.
- Hold a regular ocean-climate dialogue under the UNFCCC process to continue to build understanding and strengthen ocean and climate action.
- Strengthen financial and other support (technology transfer and capacity building) for ocean-climate action recognizing that ocean finance is climate finance – and vice versa.

The COP 25 Presidency and the incoming COP 26 Presidency held an informal meeting on ocean and climate on 29 June 2021.[5] Parties and non-Party stakeholders were invited to exchange views on next steps following the informal summary report of the Ocean Dialogue including possible actions at COP 26. A summary report of this meeting is available from the meeting webpage.

Work under the Nairobi work programme on adaptation, Technology expert committee and Executive committee of the Warsaw International Mechanism for Loss and Damage associated with Climate Change Impacts

Under its current workplan, the Warsaw International Mechanism (WIM) Executive Committee partnered with the Technology Executive Committee to produce a joint policy brief in 2020 on technologies for averting, minimizing and addressing loss and damage in coastal zones, with valuable contributions from international experts..6 The brief aims to inform policy-makers and practitioners on technological solutions to assess and manage climate-related risks comprehensively in coastal zones.

The Nairobi work programme (NWP) on impacts, vulnerability and adaptation to climate change[7] prioritized its focus on oceans, coastal areas and ecosystems, including mega deltas, coral reefs and mangroves, in 2019-2020, as mandated by SBSTA 48[8] and SBSTA 50.[9] This work was undertaken in collaboration with partners and relevant organizations and engagement is still ongoing. An expert group on oceans was set up as part of this work and publications include a supplement to the NAP technical guidelines on coastal adaptation and nature-based solutions, published on May 2021.[10]

The NWP expert group on oceans also co-organized the thematic session on innovative approaches to strengthening coastal and ocean adaptation,[11] in collaboration with International Union for Conservation of Nature (IUCN), the Friends of Ecosystem-based Adaptation (FEBA) network, and UNFCCC Technology Executive Committee (TEC) on 6 September 2021. The objective of the event is to present and discuss state-of-the-art learning and examples from integrating joint approaches of both technology and ecosystem-based adaptation in various policies and programmes in order to build the resilience of oceans and coastal ecosystems and communities.

1.3 Progress on the Marrakech Partnership on Global Climate Action

Under the leadership of the High-Level Climate Champions, the Marrakech Partnership for Global Climate Action (MP-GCA) supports implementation of the Paris Agreement by strengthening collaboration between national governments and non-Party stakeholders to enhance climate mitigation and adaptation ambition towards implementation and systems transformation. It promotes higher ambition of all stakeholders to collectively strive for the 1.5 °C temperature goal and achieve a net-zero and resilient future.

Ocean and coastal zones are one of seven key themes under the MP-GCA, which has provided a platform for stakeholders to collaborate on ocean and climate change action. The Ocean and Coastal Zones Group works towards further embedding the role of coastal and marine ecosystems in the fight against climate change. The MP-GCA on Ocean and Coastal Zones aims at bringing together all actors from civil society to speak as one voice for the Ocean. Aligned with the conclusions of the SBSTA Ocean and Climate Dialogue, it strives to establish a constructive dialogue between Parties to the UNFCCC and non-state actors for a greater recognition of the role of the ocean in climate mitigation and adaptation.

The MP-GCA theme on Ocean and Coastal Zones

5 See https://unfccc.int/event/informal-meeting-on-oceans-and-climate
6 The policy brief is available at http://www.unfccc.int/node/231688.
7 See http://www.unfccc.int/node/693.

8 FCCC/SBSTA/2018/4, para. 21(b).
9 FCCC/SBSTA/2019/2, paras. 8 and 17.
10 See https://unfccc.int/sites/default/files/resource/Ocean%20Policy%20Brief%20v1.24.03.2021.CB%20%285%29.pdf
11 See https://unfccc.int/ttclear/events/2020/2020_event07

aims to:

- Further embed the role of the ocean and coastal marine ecosystems in the fight against climate change;
- Engage non-party stakeholders on ocean-climate action to support the implementation of the Paris Agreement goals; and
- Define how to build relevant synergies between the UNFCCC, CBD and other relevant frameworks, i.e., BBNJ, IMO, Ramsar, SDGs, United Nations Environment Assembly (UNEA), UN Food Systems Summit, UN Decade of Ocean Science for Sustainable Development, UN Decade of Ecosystem Restoration, etc.

Carrying a vision for ocean-climate action: The Ocean Pathway

The Climate Action Pathways are an essential part of the MP-GCA tools to enhance climate action and ambition. First launched in 2019, they set out sectoral visions for achieving a 1.5° C resilient world in 2050, with overarching transformational milestones, and key impacts that need to be achieved to realize them. In that regard, the MP-GCA Ocean and Coastal Zones strongly supports the vision and encourages implementation of the ocean-focused Climate Action Pathway, also known as the Ocean Action Pathway.

The Ocean Action Pathway captures the latest recommendations on how to scale up sustainable ocean-based climate solutions, most notably by decarbonizing the shipping industry (note a fuller discussion on this topic by the IMO in Section 4 on mitigation), developing ocean renewable energy (see also section 4 on mitigation), implementing coastal and marine Nature-based Solutions (with further information in section 4), and achieving sustainable low-carbon seafood. To that end, it encourages every relevant stakeholder to play its part in accelerating global efforts to mitigate climate change.

Amplifying aligned campaigns: The Champions-led Race to Zero and Race to Resilience campaigns

Led by Gonzalo Munoz (Chile) and Nigel Topping (United Kingdom (UK)), the two High-Level Climate Champions for Climate Action, the Race to Zero and Race to Resilience campaigns mobilise non-state actors to catalyse a step-change in global ambition and respectively achieve a net-zero carbon and resilient future. Committed to consolidating and expanding the ocean-climate community, the MP-GCA Ocean and Coastal Zones is mobilized to support and amplify both races. It has worked to get key stakeholders to commit to strong ocean-based action, in line with the Ocean Action Pathway.

In addition to rallying leadership, the MP-GCA Ocean and Coastal Zones also works towards ensuring greater visibility of ocean-based sectors within the two campaigns. As an example, it supports the partnership between the Race to Resilience and ocean-related initiatives, such as the Global Mangrove Alliance and Ocean Risk and Resilience Action Alliance.

Mobilizing the ocean-climate community: The Ocean Action Day at UNFCCC COP26

Flagship of the ocean-climate community, the MP-GCA Ocean and Coastal Zones was mandated by the High-Level Climate Champions to convene the Ocean Action Day at UNFCCC COP26 on 5 November 2021, 2.30 - 5.30 PM. To that end, the Ocean and Coastal Zones Focal Points convened a workshop with the MP-GCA partners to collectively define key messages and share expectations ahead of COP26, ensuring these are aligned with those of the UK COP Presidency and relevant UNFCCC processes. Based on these fruitful discussions and the Ocean Action Pathway, the MP-GCA Ocean and Coastal Zones has put together an event focused on scaling-up ocean-based climate solutions to deliver a resilient, net zero, equitable, and nature-positive future.

This event will be the main multi-stakeholder ocean meeting at COP26, gathering Heads of States, local communities, business leaders, UN Organizations, scientific institutions and NGO leaders. It will showcase existing actions and strategies implemented by key stakeholders to scale-up ocean-based climate solutions for a net-zero and resilient future.

Key messages highlighted for the Ocean Action Day at UNFCCC COP26 include:

- A healthy and biodiverse ocean provides abundant and nutritious food, ensures wellbeing and preserves cultural heritage, and supports sustainable livelihoods of billions of people – as well as mitigation and adaptation solutions for climate change. The ocean and coastal zones solutions must therefore be more widely reflected in national climate commitments, strategies and implementation plans, particularly in NDCs and NAPs under the UNFCCC. In that regard, coastal and marine Nature-based Solutions (including blue carbon) have a major role to play.
- Creating and implementing the enabling conditions for action will be essential to enhance sustainable, inclusive, ocean-based climate solutions (including Nature based Solutions (NbS), sustainable seafood, ocean renewable energy and

decarbonised shipping) moving forward. Science and finance are two key enablers, and both scientific knowledge (including traditional and local knowledge) and financial flows must substantially increase to more adequately and equitably boost and inform ocean action, including through adequate policies and management frameworks.

- Putting sustainability and equity at the heart of ocean management is essential for protection, production and prosperity that benefits both nature and people. As a result, it is necessary to further develop inclusive, science-based ocean management to tap into the full potential of ocean solutions, while better protecting the ocean and restoring its health and productivity.

Raising the voice of the ocean: the Ocean for Climate Declaration

COP26 will be the 'Climate and Nature' COP. The role of nature to help deliver a net-zero world will be at the centre of attention, presenting a critical opportunity to highlight the central role of a healthy and productive ocean across climate mitigation, adaptation and resilience building goals and targets.

Building upon the work of the ocean community over the last decade, the Ocean for Climate Declaration aims to support a strong political outcome at COP26 on the intrinsic connection between the ocean and the climate. The Declaration highlights sustainable ocean-based solutions available for both climate mitigation and adaptation, as well as the key actions public and private actors should take to secure a healthy and productive ocean contributing to a resilient, biodiverse and net-zero future.

The ocean community at large (UN system organizations, NGOs, businesses, scientific institutions, voluntary initiatives, industries, cities, regions, etc.) is invited to endorse the Ocean for Climate Declaration to ensure a strong and united ocean-climate community coming to Glasgow with a set of shared priorities and "one voice''.

This document will be publicly issued ahead of Glasgow (around 20 October) with the first list of endorsements. Endorsements will be open until the opening of COP26 on November 1st, 2021.

1.4 Progress with the mobilization of UNFCCC Friends of the Ocean and Climate and associated actions

Several related initiatives address and advocate for ocean and climate issues at UNFCCC. They include *Friends of the Ocean and Climate, Because the Ocean Initiative*, the *Ocean Pathway Initiative* and the *Ocean & Climate Platform*. In this section we provide information about the recent developments relating to the work of these initiatives.

Friends of the Ocean and Climate

The Friends of the Ocean and Climate is an informal and inclusive group of UNFCCC member states that provides a space for Parties to discuss how to advance ocean-climate issues in the UNFCCC. During 2020 and 2021, the Friends of the Ocean and Climate built on its successful advocacy for a SBSTA Ocean and Climate Change Dialogue to consider how to strengthen adaptation and mitigation action and played an important role in maintaining the momentum on climate and ocean action in the face of COVID-related meeting restrictions and delays. The group accomplished this through several approaches including coordinating positions and messaging for the Ocean and Climate Change Dialogue and President Biden's Leaders Summit on Climate, other broad engagement, and focused strategy sessions in the run up to COP26.

The Friends of the Ocean and Climate group has arranged several meetings to provide a platform for Parties and non-party stakeholders to come together and discuss how the ocean-climate nexus can be included and integrated in the UNFCCC-process. On October 29, 2020 a preparatory meeting was held in the run-up for the mandated ocean climate dialogue to be held in December by invitation of the SBSTA-chair.

The group was also invited to a 2-day virtual Ocean Climate Ambition Summit in January 2021 with a high-level segment on the first day and a technical meeting following on day two. The meeting was hosted by 12 countries[12] and 12 organizations[13] and aimed to take stock and look forward towards COP26 in Glasgow with the overarching goal to increase climate and ocean ambition. The January meeting generated new "friends to the group" and experiences were shared across participants. Concrete ocean-based climate solutions such as blue carbon, sustainable fisheries and low-carbon shipping were discussed.

12 Belgium, Belize, Canada, Chile, Costa Rica, Fiji, France, Indonesia, Norway, Panama, Seychelles, Spain, and Sweden

13 Ocean Conservancy, United Nations Foundation, NRDC, Pew Charitable Trust, Environmental Defence Fund, Rare, Ocean and Climate Platform, AIDA, Blue Carbon Initiative, Conservation International, IUCN, Because the Ocean Initiative.

The Friends of the Ocean and Climate group hosted a meeting on June 22, 2021 to discuss options for Parties to advance the ocean-climate nexus at COP26 in Glasgow and beyond. Three main options were discussed for advancing the ocean-climate nexus in the UNFCCC (i.e. recurring dialogue, strengthening engagement on ocean-related issues in constituted bodies, and agenda item) and several opportunities were identified for further alignment and coherence in other fora and events (i.e. BBNJ, CBD, CCAMLR, IMO, Our Ocean Conference). There was general agreement from countries that better coordination is needed to rally countries and promote ocean-climate ambition across UN fora and events ("connect the dots"). Several options were offered for the inclusion of ocean-climate elements outside the UNFCCC, including: BBNJ, CBD, CCAMLR, IMO, and the Our Ocean Conference. Some countries noted that these opportunities could be used to take forward the priorities set at COP26 and build on ambition there with some concrete commitments.

SBSTA Ocean and Climate Change Dialogue

During COP25, UNFCCC Parties adopted a decision that acknowledged the links between the ocean and climate change and mandated a dialogue "on the ocean and climate change to consider how to strengthen mitigation and adaptation action." The dialogue, originally scheduled for June of 2020, was held virtually December 2-3, 2020.

On 29 October 2020, the Friends of the Ocean and Climate group organized a preparatory meeting to discuss goals for the dialogue and align positions. The governments of Fiji, Sweden, Chile, Norway, Indonesia, and Costa Rica hosted the meeting with support from Ocean Conservancy. There were more than 100 attendees, representing 29 Parties, 10 international bodies, and 18 non-state actor observer organizations. The meeting agenda focused on priorities developed by the Friends of the Ocean and Climate, including 1) Elevating ocean issues across the UNFCCC context, including existing UNFCCC work streams as well as NDCs and adaptation plans of the Parties; 2) Advancing ocean-climate issues and creating coherence across other regimes; and 3) Creating a foundation for progress through COP26 and beyond.

Host countries noted the need to raise global climate ambition; scale up sustainable ocean-based mitigation and adaptation; elevate the ocean-climate nexus across international fora; and create a home for the ocean in the UNFCCC. The COP26 Presidency discussed the collective interest in advancing ocean-climate issues; their focus on complementary fora and issues, including protecting 30% of the ocean by 2030; and the need for this to be a decade for action.

Key points raised by Parties included increasing ambition in national climate goals; elevating ocean issues across the UNFCCC context, including integrating ocean-based solutions in NDCs; leveraging existing platforms, such as the Marrakech Partnership for Global Climate Action and the Nairobi Work Program, to advance ocean-climate action; enhancing understanding of how ocean and climate issues are addressed in other fora and bodies—including IMO, CBD, Law of the Sea (LOS), CCAMLR, and SDG discussions—to promote ambition and ocean-climate action; creating a continued exchange of information and updates among UNFCCC and other fora and bodies; breaking down silos between ocean and climate teams at the domestic level in order to foster better coordination internationally; and ensuring that the dialogue leads to a more formal process, so there is an arrangement to ensure the UNFCCC appropriately addresses ocean-climate issues going forward.

This foundation from the Friends of the Ocean and Climate resulted in a strong dialogue and aligned outcomes, including on the need to ensure a continued platform for ocean-climate action within the UNFCCC.

The Ocean-Climate Ambition Summit

To support the creation of a permanent home for ocean issues in the UNFCCC and to increase uptake of ocean-based solutions in national climate plans, the Friends of the Ocean and Climate, with the support of Ocean Conservancy, organized the Ocean-Climate Ambition Summit, a major international climate event held January 26-27, 2021. Over 900 attendees, including government leaders, NGOs, youth, and private sector partners met virtually to highlight the role the ocean can play in the climate response. U.S. Special Presidential Envoy for Climate John Kerry gave a keynote speech in one of his first public appearances representing the Biden Administration.

The Friends of the Ocean and Climate group mobilized 14 country co-hosts and 12 NGO co-organizers. Several governments pledged important new commitments during the Summit, including an announcement by Special Envoy Kerry that the U.S. would join the Friends of Ocean and Climate Group.

Leaders Summit on Climate Event on "How ocean-based solutions contribute to Net Zero"

To help keep up the momentum on ocean-climate action and elevate the role of the ocean in the climate crisis, the Friends of the Ocean and Climate group, with the support of Ocean Conservancy and the United Nations Foundation, held a high-level meeting in the run-up to President Biden's global Leaders Summit on Climate. Held on April 20, 2020, the "How Ocean-Based Solutions Contribute to Net Zero" event brought together Special Presidential Envoy for Climate John Kerry, White House ocean-climate advisor Dr. Jane Lubchenco, and Secretary of Energy Jennifer Granholm with world leaders, including the President of the Republic of the Marshall Islands, David Kabua, the Prime Minister of Fiji, Frank Bainimarama, the Deputy Prime Minister and Minister for Justice and the North Sea of Belgium, Vincent Van Quickenborne, the Minister of Foreign Affairs of Chile, Andres Allamand, the Minister for the Environment and Energy of Costa Rica, Andrea Meza, the Minister of Climate and Environment of Norway, Mr. Sveinung Rotevatn, and Flavien Joubert, the Minister of Agriculture, Climate Change and Environment of Seychelles.

The event was an excellent opportunity to highlight the increasing number of countries that are committing to advance ocean-climate solutions in their NDCs. World leaders announced other important commitments on ocean action, including expanding ocean-based renewable energy, creating marine protected areas, promoting green infrastructure, restoring coastal habitats, and more. The U.S. NDC, released just ahead of the Summit, notably included several key ocean-climate solutions, like expanding development of offshore wind, protecting blue carbon ecosystems and decarbonizing global shipping. Special Envoy John Kerry announced the U.S. commitment to decarbonize global shipping by 2050 at the event. Public commitments like these, and their inclusion in NDCs, help generate critical resources and capacity to raise ambition and realize these commitments.

Advancing the Ocean and Climate Nexus at COP26 and beyond

In the run up to COP26, the Friends of the Ocean and Climate also hosted a meeting on June 22, 2021 to discuss options for Parties to advance the ocean-climate nexus at COP and beyond. Fourteen countries and the UNFCCC Secretariat joined for a discussion focused on next steps in advancing the ocean-climate nexus in the UNFCCC and on elevating ocean issues and creating coherence across international regimes.

Options were discussed for advancing the ocean-climate nexus in the UNFCCC and several opportunities were identified for further alignment and coherence in other fora. The successful Ocean and Climate Change Dialogue to consider how to strengthen adaptation and mitigation action was held by the SBSTA Chair in December 2020, and the informative and thorough informal report produced by the Secretariat, served as an excellent introduction to discuss the options that Parties have to advance the ocean-climate nexus in the UNFCCC.

Parties acknowledged the comprehensive nature of the report and its recommendations for further work on ocean issues within the UNFCCC and beyond. Generally, there was broad support for creating a mechanism for continued and formal consideration of the ocean-climate nexus within the UNFCCC, with several structural options discussed. The Parties also expressed strong support for continued integration of ocean climate issues in the broader UNFCCC context, including NDCs and NAPs. Countries also commented on how constituted bodies are an important space for further bolstering ocean-climate linkages at multiple governance scales, where additional progress could be made, and noted the need for more engagement on ocean-climate issues from the different bodies. There was broad agreement that better coordination is needed to rally countries and promote ocean-climate ambition across other UN fora and events, including BBNJ, CBD, CCAMLR, IMO, Ocean Decade and the Our Ocean Conference.

As they were at COP25, the Friends of the Ocean and Climate will continue to be at the center of efforts to advance the ocean-climate agenda at COP26. Further incorporating ocean issues into the UNFCCC will ensure that relevant ocean and coastal science and knowledge, climate impacts, and mitigation and adaptation solutions are not left out of critical pathways and available financing necessary to effectively and equitably tackle the challenge of climate change.

The Because the Ocean Initiative

At the Climate-Ocean Ambition Summit organized online in January 2021 by Ocean Conservancy and the Ocean & Climate Platform, the Foreign Affairs Minister of Chile, Andrés Allamand announced that Chile would promote a third 'Because the Ocean' declaration to be launched at COP26. Since then, preparations and consultations have been on-going among a large group of the 39 countries signatories to the previous Because the Ocean declarations since 2015.

The Because the Ocean Initiative was launched with a declaration at COP21 in Paris in 2015. A second declaration was launched one year later at COP22 in Marrakesh, including a call to *"consider submitting Nationally Determined Contributions that promote, as* *appropriate, ambitious climate action in order to minimize the adverse effects of climate change in the ocean and to contribute to its protection and conservation."* Accordingly, between 2016 and 2019 several workshops and other events held with support from the Prince Albert II of Monaco Foundation (FPA2), the Foreign Ministry of Chile, the Ministry for the Ecological Transition of Spain, and the Ministry of Economy of Fiji, among others, have explored the incorporation of ocean-related measures in Climate Strategies (i.e. NDCs, NAPs, Adaptation Communications and National Policy Frameworks). The outcome of the process was summarized in Ocean for Climate, released prior to COP25 held in Madrid under the Chilean Presidency.

During the Monaco Ocean Week held online in March 2021, a workshop with fifty-two persons representing 17 countries was organized to explore the appetite of countries to develop a new declaration for COP26. Three months later, in June 2021 the Chilean COP25 and UK COP26 Presidencies co-hosted an informal meeting on climate and ocean attended by 165 delegates and non-party observers in the margin of the virtual meeting of the UNFCCC Subsidiary Bodies.

Throughout the months of July and August 2021, some sixteen UNFCCC Parties exchanged drafts to build the third 'Because the Ocean' declaration, in a process facilitated by the Secretariat of the Because the Ocean Delegation. The third 'Because the Ocean' declaration will be launched at a high-level event on the first day of COP 26 (31 October).[14]

Ocean Pathway Partnership (OPP) Initiative and the Friends of the Ocean (UNFCCC)

Meetings with the Pacific Rim Ocean-Climate Action Partnership (PROCAP) – Fiji Perspective

Given Fiji's strong leadership within the ocean space, regional and global development partners frequently included Fiji in roundtable meetings, and 2021 in particular focused on the Pacific Rim Ocean-Climate Action Partnership (PROCAP). The PROCAP is jointly led by the State of California, Fiji, Costa Rica, Panama and Peru.

Fiji has joined South American countries and other American States for PROCAP which resolves to drive ambitious emissions reductions, maximize ocean-related mitigation measures and build ocean and coastal resilience as well as community and economic resilience (FijiVillage).This initiative promotes Fiji's existing commitments such as the commitment to achieving 100% management of EEZ's and 30% marine protected area coverage by 2030, and commitments to decarbonize marine shipping by 2050. Involvement with the aforementioned organization primarily revolved around progressing global, regional and national activities encapsulating the ocean agenda and advocating for stronger action via platforms such as the Sessions of the Subsidiary Bodies (SB Sessions) which were held in July, 2021 and the annual Climate Change Conference, which will be held between 1 – 12 November, 2021.

High Level Panel (HLP) for Oceans – Fiji Perspective

Fiji was among 14-world leaders to establish the High Level Panel (HLP) for a sustainable Ocean Economy. The OPP was utilized in operationalizing key activities under the HLP such as the launch of the 'Transformations for a Sustainable Ocean Economy: A Vision for Protection, Production and Prosperity' in December 2020 by the Hon. Prime Minister of Fiji.

The HLP has continued to work with the Government of Fiji (currently represented by the Permanent Representative to the United Nations, Amb. Satyendra Prasad) to catalyse and scale bold, pragmatic solutions across policy, governance, technology and finance to ultimately develop an action agenda for transitioning to a sustainable ocean economy. Recently, the HLP has partnered with the Organization for Economic Cooperation and Development (OECD) to identify possible avenues of increasing resiliency within ocean sectors and discussions are currently ongoing in area with representatives from the Ministry of Economy.

The HLP progresses work in its multiple areas of interest through an expert group and an advisory network with Fiji represented on both. The Ocean Panel Secretariat based with the World Resource Institute (WRI) assists with analytical work and science, communications and stakeholder engagement.

Next Steps

- Coordinate Friends of the Ocean and Climate members and all parties and partners to support strong outcomes moving into COP26 from the Ocean Dialogue in SBSTA and May-June 2021 Climate Change Climate Conference, Sessions of the Subsidiary Bodies. This will include the preparation of negotiators and options papers that will help provide linkages of oceans in the UNFCCC.
- Preparations for UN Ocean Conference including participation at High Level Panel for Oceans and 100% Ocean Management Action Group, UN

14 For details, please see https://www.becausetheocean.org/cop26-launch-of-the-3rd-because-the-ocean-declaration/

voluntary commitments and events at UN Ocean Conference. This further includes preparation of policy documents and frameworks that will guide the meetings.

- Follow up online/virtual with Friends of the Ocean Coordination.
- Participate in Small Island Developing States (SIDS) meetings, COP 26 Presidency, CROP agencies on Meeting follow-up from COP25.
- Organize High Level political forum and events at COP26 to deliver on the ocean-climate nexus and bolster ambition and momentum.
- Convene various roundtables, symposiums and address existing meetings that bring stakeholders together to raise ambition with 2021 commitments for ocean and climate actions on the topic of financing ocean economies including green shipping, ocean biodiversity, policy and governance and coastal cities and islands.
- Mobilize ocean discussions at the national, regional and international space through NGO's, CSO's and private sector.
- Supporting Friends of the Ocean events and online and virtual platforms to design and socialize communications materials.
- Support national implementation of activities under the OPP such as on the ocean-climate nexus and those at the regional scale that provide ocean resilience from the impacts of climate change.
- This will support local coordination of ocean-climate activities that allows Fiji to prepare its international advocacy on ocean-climate nexus through the OPP.

The Ocean & Climate Platform

Since 2014, the Ocean & Climate Platform (OCP) has been working towards a better understanding of ocean-climate-biodiversity interactions and a better integration of the ocean in climate negotiations. With a network of 97 members, OCP fosters reflections and cooperation between the scientific community, civil society and policy makers. Buoyed by its long-standing commitment to climate change mitigation, OCP believes that while it is crucial to continue to push for ambitious greenhouse gases emission reductions, it is also urgent to prepare for the future and adapt to a changing world and climate.

Sea'ties – Sharing solutions with coastal cities to tackle sea level rise

The IPCC *Special Report on the Ocean and Cryosphere in a Changing Climate,* published in 2019, is unequivocal: sea levels have been rising at an increasing rate over the past century and could rise by more than a metre by 2100, with extreme sea level events becoming more frequent and severe. Worldwide flooding, shoreline erosion, hazards from storms, salinization of land and drinking water, as well as the destruction of ecosystems all threaten coastal populations, infrastructures and economies. Coastal cities are particularly exposed to these risks as they are densely populated and concentrate a large share of economic assets.

Adapting cities to the cascading impacts of sea level rise is therefore a pressing challenge. However, the design and implementation of efficient, equitable and sustainable adaptation policies is undermined by a lack of understanding of both the risks and solutions available. This is especially challenging for medium-sized cities, which can be subject to reduced capacity and insufficient funding.

In response to this challenge, the Ocean & Climate Platform launched Sea'ties, an Ocean Decade endorsed international initiative to facilitate coastal cities' adaptation to sea level rise and enhance global resilience to climate change. Spanning across five regions – Europe, the Mediterranean, the US West coast, West Africa, and the Pacific – Sea'ties reviews the range of existing solutions for adaptation and identifies the enabling conditions of their successful implementation. The digital *Sea'ties Solutions Map* centralizes an up-to-date inventory of adaptation responses deployed worldwide.

With a particular attention to environmental and psychosocial components, the Sea'ties initiative also aims to foster cross-sector collaboration. In order to enable the exchange of knowledge, innovations and concrete returns on experience, technical workshops will be held in each five regions of the project. This work will enable the OCP to promote good practices and produce recommendations to best support the adaptation of coastal cities to sea level rise.

So far, evidence indicates the necessity to change approaches to coastal management, which presently generally focus on protecting cities from the sea by building hard infrastructure which can exacerbate erosion, affect the seabed and impact neighbouring coasts. It is paramount to design new models defining coastal adaptation as an on-going and transitional process, able to adapt to new climate conditions and to integrate broader societal goals.

Figure 1. Sea Level Rise: What Impacts for Coastal Cities and their Regions? Credit: ocean-climate.org

While there is not one-size-fit-all solution, we emphasize the importance of adopting a hybrid approach. Such a hybrid approach combines technologies aimed at reducing risks, for instance defensive work, nature-based solutions, accommodation solutions and managed retreat. This approach also highlights the need to engage stakeholders extensively in the elaboration process to develop adaptation strategies, as well as the interest in planning coastal adaptation on a large territorial scale. Following this logic of action enables the development of flexible and integrated systems better suited to the complex social, geographical, environmental, and economic palette of cities and their surrounding territory.[15]

1.5 Progress in other fora outside of the UNFCCC

A number of processes established by the United Nations General Assembly with mandates related to oceans have addressed issues related to ocean and climate change, as summarized below. This section provides an update on efforts supported through the UN Division for Ocean Affairs and the Law of the Sea (UNDOALOS).

The Division for Ocean Affairs and the Law of the Sea, Office of Legal Affairs of the United Nations, provides secretariat services to many of such ocean-related processes. The Division also acts as the secretariat of the United Nations Convention on the Law of the Sea and its Implementing Agreements. The General Assembly proclaimed in 2017 its support for the UN Decade of Ocean Science for Sustainable Development.[16] This section also provides an update on the UN Decade of Ocean Science for Sustainable Development, coordinated by IOC UNESCO. Updates from other global developments, including the implementation of the SDGs and developments related to the CBD post-2020 global biodiversity framework are provided.

Developments in the General Assembly of the United Nations and related processes

The General Assembly has drawn the link between oceans and climate change in various resolutions. As it has done in recent years, in the latest annual resolution on Oceans and the Law of the Sea (resolution 75/239 of 31 December 2020), the General Assembly continued to reiterate its serious concern at the current and projected adverse effects of climate change and ocean

15 More information: https://ocean-climate.org/en/seaties-2/

16 https://oceanconference.un.org/commitments/?id=15527

acidification on the marine environment and marine biodiversity and emphasized the urgency of addressing these issues. It expressed concern that climate change continues to increase the severity and incidence of coral bleaching throughout tropical seas and weakens the ability of reefs to withstand ocean acidification, which could have serious and irreversible negative effects on marine organisms, particularly corals, as well as to withstand other pressures, including overfishing and pollution. The Assembly also reiterated its deep concern at the vulnerability of the environment and the fragile ecosystems of the polar regions, including the Arctic Ocean and the Arctic ice cap, which are particularly affected by the observed and projected adverse effects of climate change and ocean acidification. In addition, it expressed its concern regarding an increase in the adverse impacts on countries, particularly developing countries, of climate change, including from, inter alia, extreme weather events, sea level rise, coastal erosion and ocean acidification (preamble and para. 210).

The Assembly again called for the development and strengthening of capacity-building activities in developing countries and the transfer of sound technologies to study and minimize the impacts of ocean acidification. It stressed the importance of increasing the scientific understanding of the oceans-atmosphere interface, including through participation in ocean observing programmes and geographic information systems, such as the Global Ocean Observing System, sponsored by the IOC, UNEP, the WMO and the International Science Council (ISC), particularly considering their role in monitoring and forecasting climate change and variability and encouraged States and others to urgently pursue further research on the oceans-atmosphere interface, the effects of climate change on the marine environment and marine biodiversity, and ocean acidification. It recalled the importance of assessments such as those prepared under the IPCC, the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) and the Regular Process and encouraged States and relevant international institutions to address levels of ocean acidity and the negative impact of such acidity on vulnerable marine ecosystems, particularly coral reefs, and improve efforts to address coral bleaching (paras. 22, 214, 215, 276, 298 and 310).

The Regular Process for Global Reporting and Assessment of the State of the Marine Environment, including Socioeconomic Aspects (Regular Process)

The Regular Process is a global mechanism established by the General Assembly after the 2002 World Summit on Sustainable Development to regularly review the environmental, economic and social aspects of the world's oceans.

The Second World Ocean Assessment (WOA II), released earlier in 2021, identifies climate change as one of five main drivers of change in the ocean. It devotes two chapters to issues related to climate change and oceans: Chapter 5 on "Trends in the physical and chemical state of the ocean" (sea temperature; sea levels; salinity; ocean circulation, including stratification, mixing, upwelling, boundary currents and gyres and oscillation patterns; sea ice; ocean chemistry, including ocean acidity; and dissolved oxygen); and Chapter 9 on "Pressures from changes in climate and atmosphere" (physical properties of the ocean, including effects on the distribution and seasonal cycles of biota and coastal communities; ocean chemistry, including calcium carbonate production and the effects on biota, beaches and atolls; extreme climate events, including their impacts on biota, beaches, coastal communities, shipping and marine infrastructure).

The United Nations Open-ended Informal Consultative Process on Oceans and the Law of the Sea (the Consultative Process)

The Informal Consultative Process (ICP) is a subsidiary body established by the General Assembly in resolution 54/33 of 24 November 1999 to facilitate its annual review of developments in ocean affairs and the law of the sea by considering the report of the Secretary-General on oceans and the law of the sea and by suggesting particular issues to be considered, with an emphasis on identifying areas where coordination and cooperation at the intergovernmental and inter-agency levels should be enhanced.

In recent years, the Informal Consultative Process discussed the following themes relevant to ocean and climate: marine renewable energies (2012); the impacts of ocean acidification on the marine environment (2013); and the effects of climate change on oceans (2017). The documentation and outcome of these meetings are available online.[17]

In resolution 74/19, the General Assembly decided that the twenty-first Meeting of the Informal Consultative Process would focus its discussions on the theme "Sea-

17 https://www.un.org/Depts/los/consultative_process/consultative_process.htm.

level rise and its impacts" (A/RES/74/19). In resolution 75/239, the Assembly confirmed this topic for the meeting, which was postponed to 2021 due to the impacts of COVID-19. To inform discussions on the area of focus at the meeting, the Secretary-General prepared a report (document A/75/70).

The meeting focused on the characterization and extent of sea level rise, including regional variability, and its environmental, social and economic impacts. It also highlighted the urgency of sea level rise and the impacts of the increasing frequency of extreme weather events for SIDS and coastal States including low-lying coastal areas. Attendees also discussed the various mitigation and adaptation responses urging that measures are taken urgently and stressing possible challenges such as their cost, data gaps and challenges for modelling and monitoring sea level rise. Lastly, participants stressed the importance of the science-policy interface and cooperation at all levels and with all stakeholders, the relevance of traditional and local knowledge, of the ocean-climate nexus and of the legal dimension, and the need for international cooperation and coordination, capacity-building, national planning processes, and financing. A complete report of the meeting is contained in document A/76/171.

The United Nations Decade of Ocean Science for Sustainable Development

In December 2017, the Assembly proclaimed a Decade of Ocean Science for Sustainable Development to be held from 2021-2030. The Ocean Decade provides a common framework to ensure that ocean science can fully support countries to achieve the 2030 Agenda for Sustainable Development. The Ocean Decade will be cross-cutting in its efforts to address all 17 SDGs, but has a particular focus on SDG 14, to conserve and sustainably use the oceans, seas and marine resources for sustainable development. The IOC was tasked by the Assembly to prepare an Implementation Plan for the Ocean Decade in consultation with Member States and a diversity of stakeholders (see section 1.6 for further discussion of the SDGs).

The Implementation Plan outlines ten Decade Challenges that represent the most immediate and pressing needs over the next decade. The Decade Action Framework will guide stakeholders as they come together to co-design and co-deliver a wide range of tangible initiatives (Decade Actions) to achieve three Decade Objectives: 1) identify required knowledge for sustainable development, 2) generate comprehensive knowledge and understanding of the ocean and 3) increase the use of ocean knowledge. Together, this Framework will transform the "ocean we have" to the "ocean we want". The "ocean we want" is defined by seven Decade Outcomes including a clean ocean, a healthy and resilient ocean, a productive ocean, a predicted ocean, a safe ocean, an accessible ocean, and an inspiring and engaging ocean. An enhanced understanding of the ocean-climate nexus is central to addressing all of the ten Decade Challenges.

1.6 Other global developments

Several other global developments are important for the ocean-climate nexus. They include the CBD post-2020 biodiversity framework, and the UN Sustainable Development Goals (SDGs) and particularly SDG 14 on the ocean. The latter also includes work of the High Level Political Forum on Sustainable Development.

The growing national and regional efforts that build on global developments should be noted as well. These include the factoring of ocean issues into NDCs and Adaptation communications (see section 3 below), the development of National Ocean Policies that include climate considerations and regional frameworks for region-specific climate action in relation to marine and coastal areas.

CBD post-2020 global biodiversity framework

Parties to the Convention on Biological Diversity (CBD) are developing its post-2020 global biodiversity framework as a stepping stone towards the 2050 vision of "living in harmony with nature". The negotiations to develop the post-2020 global biodiversity framework, prior to the fifteenth meeting of the Conference of the Parties to the CBD, are being undertaken by a dedicated open-ended intersessional working group. The draft framework includes several ocean-related targets that are abbreviated here for their marine content as follows: 20% of degraded marine ecosystems under restoration (Target 2); 30% of sea areas protected (Target 3); management action to enable recovery and conservation of species and genetic diversity (Target 4); sustainable harvesting, trade and use of wild species (Target 5); prevent or reduce rate of introduction of invasive alien species by 50% (Target 6); reduce pollution, including by reducing nutrients by at least half, pesticides by at least two thirds, and eliminating the discharge of plastic waste (Target 7); minimize the impact of climate change on biodiversity, contribute to mitigation and adaptation through ecosystem-based approaches (Target 8); ensure benefits for people through sustainable management of marine species, and protecting customary sustainable use by indigenous peoples and local communities. The full wording of the targets can be found in document CBD/WG2020/3/3.[18]

At the present time, Target 8 is the only target referring to climate change. Targets 2 through 10, 12 and 18 reference oceans, marine species or marine-related activities, either explicitly or implicitly. For the first time, the targets include specific action relating to ecosystem restoration. The targets, once adopted, can provide the basis for improved management of ocean ecosystems, species and genetic diversity, and thus for ocean and coastal adaptation and mitigation action. It should be noted that it would be appropriate to include consideration of the significant pressures upon the ocean, such as overfishing, at the level of the implementation monitoring framework and its indicators.

Sustainable Development Goals (SDGs)

Ocean and climate action are separated into two different SDGs. Goal 13 focuses on climate action while Goal 14 focuses on oceans, seas and marine resources for sustainable development. While all SDGs and their targets, including Goals 13 and 14, are meant to be implemented in a holistic manner, taking into account their interlinkages, in practice Goal 13 does not mention the ocean, and Goal 14 mentions climate change only through target 14.3 – reduce ocean acidification. This makes it challenging to create synergies between the two. However, in implementation, many countries, as well as many voluntary commitments[19] relating to Goal 14 have incorporated climate adaptation and mitigation, demonstrating that a number of countries have made links between climate change plans and national ocean policies.

The High-level Political Forum (HLPF) is the United Nations central platform for follow-up and review of the 2030 Agenda for Sustainable Development and the SDGs. The HLPF meets annually under the Economic and Social Council. The 2020 meeting was held from 7 to 16 July, while the 2021 meeting was held from 6 to 15 July.

In the 2020 HLPF, participants debated where they stand on the SDGs in light of the impact of the COVID-19 pandemic. They reflected on how the international community can respond to the pandemic in a way that puts it back on track to achieve the SDGs and accelerate progress during the decade of action and delivery for sustainable development. The 2021 HLPF discussed ways to ensure a sustainable and resilient recovery from COVID-19 to realize the 2030 Agenda. The 2021 HLPF also addressed climate change among other SDGs. In 2020, 47 countries carried out voluntary national reviews (VNRs) of their implementation of the 2030 Agenda. In 2021, 42 countries carried out VNRs. While several countries noted climate impacts and climate policies or response measures, particularly in the 2021 VNRs, only a few noted the intersection between climate and the ocean.

1.7 Regional developments

This section provides updates from selected regions where collective progress on ocean and climate issues has been made, and includes the work of regional conventions. One important development regionally is an initiative relating to sea level rise and maritime zones in low-lying coastal areas and islands, and a discussion of this topic is provided here. The section also provides an example of implementation from the European Commission.

Regional conventions

Regional seas conventions are the appropriate level to operationalize ocean and climate issues, and some regional seas conventions and action plans have considered incorporating climate change issues into their work. For example, the UNEP/MAP-Barcelona convention provides a framework for region specific climate action through the Regional Climate Change Adaptation Framework for Marine and Coastal Areas.[20] Adopted in 2016, the instrument charts a regional approach to bolstering the resilience of the natural and socio-economic systems in the Mediterranean region.

In the Red Sea / Gulf of Aden, the Regional organization for the conservation of the environment in the Red Sea and Gulf of Aden (PERSGA) established a Climate Change Program as early as 2008. The program has executed multilinked interventions that incorporate local, national and regional activities and initiatives in the Red Sea and Gulf of Aden region. The program interventions mainly support and facilitate vulnerability assessments and studies, coastal and marine adaptation planning, capacity building, regional coordination and on-the-ground projects, which focus on adaptation to the impacts of climate change and building resilience of marine ecosystems and coastal communities. The program puts special emphasis on ecosystem based actions, pursuing Ecosystem Based Adaptation that addresses adaptation measures based on key marine ecosystem (coral reefs, mangrove and seagrass); and Ecosystem-based Mitigation that centers on the role blue carbon habitats (mangroves, seagrass, and coastal wetlands) in the region.

18 The CBD first draft of the post-2020 global biodiversity framework is online at https://www.cbd.int/doc/c/abb5/591f/2e46096d3f0330b08ce87a45/wg2020-03-03-en.pdf

19 Registry of UN Ocean Conference voluntary commitments is online at https://oceanconference.un.org/commitments/

20 https://wedocs.unep.org/bitstream/handle/20.500.11822/17500/rccaf_eng.pdf

Legal tools for addressing sea-level rise

In 1989 the Conference of Small States, hosted by the Maldives, adopted the *Malé Declaration* on Global Warming Sea Level Rise that warned of the future dangers for low lying coastal and Island States in face of rising sea levels caused by climate change and called for action by the global community. In 1990, the IPCC first assessment of climate change highlighted the risks of sea level rise caused by climate change. Despite the scientific warnings, the 1990 UNFCCC did not address sea level rise. Scientific studies have since established the unprecedented nature of sea level rise directly linked to climate change, for at least the past 3000 years. However, in 2015 the Paris Agreement did not address this pressing issue for millions of people inhabiting low-lying coastal areas and islands that are losing territory to rising sea levels. In addition to the direct threat of sea level rise to the livelihoods of millions, including displacement, there are important legal consequences.

Because of rising levels of the sea, low-lying coastal areas and islands stand to lose valuable maritime zones. These zones (territorial sea, contiguous zone, continental shelf and EEZ) are legal creations. They are established from a legal baseline that creates the territorial sea. The EEZ is the most expansive and allows coastal States exclusive sovereign rights to the resources within a marine space of up to 200 nautical miles as measured from the territorial sea baseline. However, due to rising sea levels and coastal regression, this original baseline – determined based upon small offshore features or points on a coast – could be inundated and disappear entirely. The question is whether international law requires that a new baseline be established. If so, it's new position will move landward and this would result in the landward shift of all other maritime zones, including the EEZ, which is the legal boundary between the coastal State's exclusive sovereign rights over all resources and that of the high seas, an area where all States have open access. This could result in the loss of entitlements in some cases. In short, the coastal State could lose valuable legal rights over a large area of ocean space.

Sea-level rise may also adversely impact archipelagic States that have established archipelagic waters in accordance with article 47 of UNCLOS, which allows archipelagic baselines to be drawn from the outermost lying islands or drying reefs based on a fixed formula. The loss of an outermost island or drying reef because of sea level rise could result in change in the formula and the possible loss of the right to have archipelagic waters. This would produce significant loss of a valuable maritime zone and legal rights.

More dramatic is the possibility for an island, which under the Law of the Sea is entitled to all maritime zones, to legally devolve into a rock that cannot sustain human habitation or an economic life of its own under article 121(3) of UNCLOS. In such case, the island State could lose its legal entitlement to its EEZ and possibly continental shelf. If the island sinks further into a low-tide elevation, under international law it would not be entitled to any maritime zone, including a territorial sea. The worst case scenario, is the legal question of whether an island could actually lose statehood.

Adaptation to climate change is a key part of the legal framework under the UNFCCC and the Paris Agreement. Responding to the adverse consequences of sea-level rise needs to include international law as part of the tools of adaptation and response measures. In other words, international law should also adapt to the legal consequences of sea-level rise by devising legal solutions, such as recognizing the right of States impacted by sea level rise because of climate change to preserve existing legal rights from maritime zones boundaries that have been established in accordance with international law and received international recognition. The same is true in relation to the status of inhabited islands which are lawfully entitled to all maritime zone under the law of the sea in the case they may become uninhabitable or disappear in whole or in part because of sea-level rise.

Other regional developments: European Commission

In December 2019, the European Commission presented The European Green Deal – a roadmap for making the EU's economy sustainable by turning climate and environmental challenges into opportunities across all policy areas and making the transition just and inclusive for all. Ocean is an integral part of this policy and provides an example of such regional efforts.

Preserving and restoring ecosystems and biodiversity in the European Union (EU)

A sustainable 'blue economy' will have to play a central role in alleviating the multiple demands on the EU's land resources and tackling climate change. The role of oceans in mitigating and adapting to climate change is increasingly recognised. The sector can contribute by improving the use of aquatic and marine resources and, for example, by promoting the production and use of new sources of protein that can relieve pressure on agricultural land. More generally, lasting solutions to climate change require greater attention to nature-based solutions including healthy and resilient seas and oceans. The Commission will analyse the findings of the IPCC special report on oceans and propose measures in the maritime area. This will include ways to manage maritime space more sustainably, notably to help tap into the growing potential of offshore renewable energy. The Commission will also take a zero-tolerance approach to illegal, unreported and unregulated fishing. The 2020 United Nations Ocean Conference in Portugal will be an opportunity for the EU to highlight the importance of action on ocean issues.

To set into legislation the political ambition of being the world's first climate neutral continent by 2050, the Commission presented in 2020 the first 'European Climate Law'. To reach our climate and environmental ambition, the Commission also presented the Biodiversity Strategy for 2030, and the Farm to Fork Strategy for sustainable food.

More specifically, the Biodiversity Strategy brings forward concrete steps to put Europe's biodiversity on the path to recovery by 2030, including transforming at least 30% of Europe's lands and seas into effectively managed protected areas.

EU Investments in International Ocean Governance

In line with the International Ocean Governance agenda, the EU will support the conclusion of an ambitious legally binding agreement on marine biological diversity of areas beyond national jurisdiction (BBNJ). It must set clear global procedures for identifying, designating and effectively managing ecologically representative marine protected areas in the high seas. It should be ratified and implemented as quickly as possible.

The EU should also use all of its diplomatic leverage and outreach capacities to help broker agreements on the designation of three vast Marine Protected Areas in the Southern Ocean, two of which were co-proposed by the EU in East Antarctica and in the Weddell Sea. If agreed, this would constitute one of the biggest acts of nature protection in history.

The EU will apply zero tolerance towards illegal, unreported and unregulated fishing and will combat overfishing, including through WTO negotiations on a global agreement to ban harmful fisheries subsidies.

In international negotiations, the EU should advocate that marine minerals in the international seabed area cannot be exploited before the effects of deep-sea mining on the marine environment, biodiversity and human activities have been sufficiently researched, the risks are understood and the technologies and operational practices are able to demonstrate no serious harm to the environment, in line with the precautionary principle and taking into account the call of the European Parliament. In parallel, the EU will continue to fund research on the impact of deep-sea mining activities and on environmentally-friendly technologies. The EU should also advocate for more transparency in international bodies such as the International Seabed Authority.

In terms of budget, the EU's long-term budget for the next seven years will provide support to the green transition. 30% of programmes under the 2 trillion 2021-2027 Multiannual Financial Framework and NextGenerationEU are dedicated to supporting climate action.

The Commission set up "5 EU missions" including on ocean in the context of the Horizon Europe research and innovation programme for the years 2021-2027. They support the European Green Deal. They will address the ocean and waters as one, and play a key role in achieving climate neutrality and restoring nature. More specifically, the Ocean mission (Restore our Ocean and Waters by 2030) will help achieve the EU objectives of protecting 30% of the EUs sea area as well as restoring marine eco-systems and 25.000 km of free flowing rivers, prevent and eliminate pollution by reducing plastic litter at sea, nutrient losses and use of chemical pesticides by 50% and make the blue economy climate-neutral and circular with net-zero maritime emissions.

1.8 Future directions: How to strengthen synergies between the Climate and Biodiversity Conventions?

The UNFCCC and the CBD were both adopted at the Rio Earth Summit, in 1992. The two Conventions were created to be compatible from the outset and this strong potential for complementarity has only grown since then. However, despite these promising signs, cooperation mechanisms remain weak and insufficient. There is no common vision or long-term strategy between the climate and biodiversity regimes.

A movement has emerged over the last several years to bridge these gaps and overcome this lingering tendency to work in silos. Building synergies among the climate and biodiversity regimes will be a decisive move towards effective and holistic governance, and the ocean has a key role to play in this climate- biodiversity reconciliation. Indeed, addressing the decline in ocean health, climate change and biodiversity separately could seriously jeopardise our ability to deal with these critical challenges.

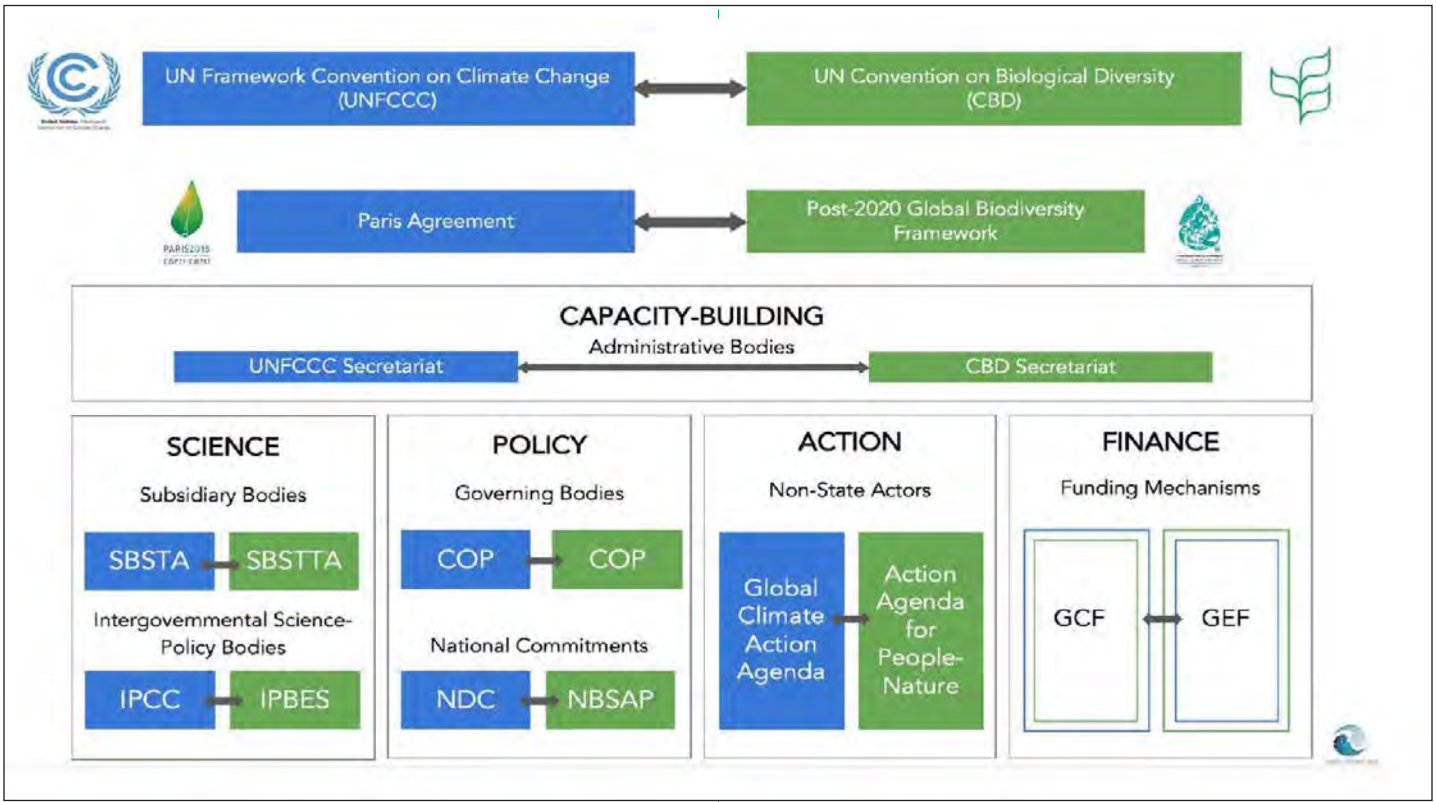


Figure 2. Building bridges between the UNFCCC and the CBD[21]

Integrating the ocean, climate and biodiversity agendas implies identifying what swimming the talk means and how it can be done in a comprehensive manner, while not overstepping the scope of each Convention. This comprehensive approach necessitates building on enhanced collaboration and cooperation among the scientific community, policymakers, civil society and the financial world (see Figure 2).

Science: Supporting science-based and evidence-based decision-making

In a fast-changing world that faces the increasing threat of climate change and nature degradation, reducing uncertainties in global environmental governance is key, and rests on our ability to assess and render knowledge accessible to policymakers. Considering the key role science now plays in policymaking, it is crucial to further integrate the ocean-climate-biodiversity nexus in scientific research so that scientists can continue to support informed decision-making and prompt policymakers to further consider ocean, climate and biodiversity interactions. Intergovernmental science-policy bodies (i.e. IPCC and IPBES) have a key role to play in this regard. Further coordination between IPCC and IPBES could strengthen the way scientific evidence is valued to boost effective decision-making, while strengthening the science-policy interface around the ocean-climate-biodiversity nexus. Similarly, further collaboration between the Conventions' Subsidiary bodies (i.e., SBSTA and SBSTTA) could boost synergies between the CBD and UNFCCC. Placing science and science-based objectives at the center of policymaking is not only a priority to ensure sound decisions, it is also a necessity to align ambitions and enhance action.

Policy: Increasing political coherence between ocean, climate and biodiversity strategies

Aligning ambitions will send a resounding political signal in favour of common ocean, climate and biodiversity action, allowing us to effectively move forward. In that regard, coordinating national commitments (i.e., NDCs and National Biodiversity Strategies and Action Plans or NBSAPs) is an opportunity to align ambition towards both climate-smart and biodiversity-neutral or, ideally, biodiversity-positive targets. We need to start qualifying and quantifying the climate footprint of NBSAPs and the biodiversity footprint of NDCs. It will optimise the best tradeoffs and co-benefits between ocean, biodiversity and climate actions, both nationally and collectively at the international level. In addition to national commitments, similarities between the two conventions allow for opportunities to strengthen collective efforts for integration at the international level. The two Governing bodies (i.e. each COP) could increase communication and cooperation between one another, and further consider setting up joint actions to better integrate ocean-climate-biodiversity considerations in their strategies.

21 Picourt, L., Lecerf, M., Goyet, S., Gaill, F., Cuvelier, R. & Parmentier, R. (2021), Swimming the talk: How to strengthen collaboration and synergies between the Climate and Biodiversity Conventions?, Policy brief, May 2021, OCEAN & CLIMATE PLATFORM, p.1-14

Action: Strengthening the ties between ocean, climate and biodiversity non-state actors

Non-State actors are agents of change and drivers for increased ambition, and the voice of civil society is undoubtedly stronger when united. Building bridges among climate and biodiversity communities of non-state actors, including among the two action agendas (i.e., Global Climate Action Agenda and Action Agenda for People and Nature), could therefore be a game-changer in the way non-party stakeholders mobilise and influence decision-makers to tackle the climate and biodiversity crisis as one and the same. In the longer run, the Global Climate Action Agenda and the Action Agenda for People and Nature could create new forms of collaboration. Building on the existing overlaps between the themes covered by both action agendas, joint work streams could be established to achieve common goals.

Finance: Mobilising resources to advance the ocean, climate and biodiversity nexus

Money is the crux of every issue and addressing the climate-biodiversity crisis is no exception. As a result, strengthening the ocean-climate-biodiversity nexus must also be further achieved by better reflecting it in investments or financing strategies, as well as by increasing collaboration across the financial mechanisms and institutions. Existing entities must put aside specific funding for joint activities, ensuring coherence and complementary through concrete work. For example, the Global Environment Facility (GEF) and the Green Climate Fund (GCF), which already operate with both Conventions, could strive to build bridges between their respective workstreams, mainstreaming climate issues in biodiversity projects and vice versa. To date, blue investments are still lagging behind. SDG 14 "Life below water" received less investments for its implementation than all other goals,[22] which speaks for itself. This significant gap in resource mobilisation must be overcome to support mitigation, adaptation and conservation actions.

Swimming in harmony with nature: Looking at 2021 and beyond

Halfway through 2021, the road ahead remains long and steep if we want to see real change in favour of protecting global biodiversity and tackling climate change. Some existing entry points have already been identified and need to be strengthened to ensure an integrated ocean-climate-biodiversity governance. Policymakers, together with the scientific community, civil society and financial world must continue to work towards breaking down silos to achieve this comprehensive governance. The international community found effective ways to move forward and maintain the momentum during the global pandemic, turning 2021 into the (new) "Super Year" for Ocean, Climate and Biodiversity. Let's make it count so that when we meet at Rio+30, in 2022, we can celebrate "a healthy ocean for a protected climate". The full policy brief of the Ocean & Climate Platform is available online.[23]

1.9 Summary of achievements and future needs on integrating ocean and climate action

This section demonstrates considerable progress in further incorporation of ocean issues into the work of UNFCCC, including in particular through the convening of the UNFCCC SBSTA Ocean and Climate Change Dialogue in late 2020. This progress has been actively promoted by many of the groups reporting in this section: the Marrakech Partnership for Global Climate Action, Friends of the Ocean and Climate, the The Ocean-Climate Platform, the Ocean Pathway Partnership (OPP) Initiative and the Friends of the Ocean (UNFCCC). These groups have also held many important meetings of their own, including the two declarations on ocean and climate that will be presented for signature at COP 26: the Ocean for Climate Declaration and the third Because the Ocean declaration.

Progress on ocean-climate issues has also been made outside of the UNFCCC, including in declarations of the General Assembly, in the work of the ICP on sea level rise, the Second World Ocean Assessment on the ocean and climate, and the UN Decade of Ocean Science for Sustainable Development. Regionally, regional seas programmes and regional partnerships have made progress in further considering climate change adaptation and mitigation in marine and coastal areas. Concerns remain, particularly in regions such as the Pacific, on the lack of legal tools that would allow countries to retain, in the face of rising seas, their existing maritime zone boundaries established in accordance with international law. This is an issue that still requires urgent attention.

There is also still a need for raised ambitions in commitments for ocean and climate action, which includes the integration of the ocean into climate solutions. There is also a need for better coordination between

22 OCDE (2020), Sustainable Ocean for All: Harnessing the Benefits of Sustainable Ocean Economies for Developing Countries, The Development Dimension, Éditions OCDE, Paris. Available at: https://www.oecd.org/environment/sustainable-ocean-for-all-bede6513-en.htm

23 https://ocean-climate.org/wp-content/uploads/2021/05/Policy-brief_CBD_UNFCCC-VF.pdf

international processes that consider the ocean/climate interface, including between UNFCCC, CBD, IMO, the BBNJ-process, the SDG 14 process, and the Our Ocean Conference.

OceanImageBank_SrikanthMannepuri


OceanImageBank_ErikLukas

2. NEW SCIENTIFIC FINDINGS ON THE OCEAN AND CLIMATE, UNDERSCORING THE NEED FOR URGENT ACTION AND APPROPRIATE POLICIES

This section will look at recent reports relevant to the ocean-climate interface, as well as latest findings from peer-reviewed research.

2.1 Recent reports and research

According to IPCC AR6, published in 2021, marine heatwaves have become more frequent over the 20th century, and are also projected to increase around the globe over the 21st century. This warming is likely to further decrease oxygen concentrations, with deoxygenation projected to last for thousands of years. It is also virtually certain that global mean sea level will continue to rise for centuries to millennia due to continuing deep ocean heat uptake and mass loss from ice sheets. Ocean acidification has increased globally over the past four decades, and in the open ocean, acidification, changes in sea ice, and deoxygenation are detectable in many areas.

There are regional differences, for example, the surface of the North Atlantic Ocean, the eastern equatorial Pacific Ocean and the Southern Ocean have warmed more slowly than the global average, or slightly cooled, whereas the Indian Ocean has warmed faster than the global average. The largest changes in the frequency of marine heatwaves are projected to occur in the Arctic Ocean and the western equatorial Pacific Ocean.

Many consequences of climate change will become irreversible over time, most notably melting ice sheets, rising seas, species loss and more acidic oceans. And the impacts will continue to mount and compound as emissions increase. The report notes that the chance of exceeding tipping points, such as sea level rise due to collapsing ice sheets or ocean circulation changes, cannot be excluded from future planning. Their likelihood increases with greater warming. At 3 degrees C (5.4 degrees F) and 5 degrees C (9 degrees F), respectively, projections suggest an eventual near-complete loss of the Greenland Ice Sheet (which holds enough ice to raise sea levels by 7.2 meters or 23.6 feet) and complete loss of the West Antarctica Ice Sheet (which holds ice equivalent to 3.3 meters or 10.8 feet of sea level rise). Melting of this level will redefine coastlines everywhere.

The IPCC AR 6 concluded that carbon sinks both on land and in the ocean were at risk – a concerning finding considering that according to the IPCC Special Report on the Ocean and the Cryosphere, the ocean absorbs approximately 25 percent of excess atmospheric carbon dioxide (CO_2) directly. This carbon absorption does, however, come with the price of increasing ocean acidification. There is no doubt, however, that the ocean is part of the solution. The High Level Panel for a Sustainable Ocean Economy found in 2019[24] that ocean-based climate action could deliver up to 21% of the emissions reductions needed by 2050 to limit global temperature rise to 1.5 degrees C. These solutions include ocean-based renewable energy, decarbonizing marine transport, restoring and protecting blue carbon ecosystems, and low-carbon ocean-based sources of food.

2.2 Recent peer-reviewed research

Open ocean and deep-sea ecosystems play an important role in sequestering CO_2, but are also impacted by climate change through warming, oxygen loss, increasing acidification, and changing particulate organic carbon flux (which affects food supply to the deep ocean), with consequences that include loss of species, redistribution of productivity, habitat compression, and biodiversity loss.[25] Consequences also include changes in body size, food webs and connectivity that can influence commercial harvest, carbon sequestration and nutrient cycling. These impacts add together with impacts resulting from increasing human uses of the deep ocean, including bottom fishing, oil and gas extraction, and deep-seabed mining.[26] A recent publication[27] points out that the IPCC reports are not able to highlight potential vulnerabilities and risk in areas where research is largely absent. However, in situ observations are still lacking, as discussed in the section on knowledge gaps (section 2.3).

Results from models show that climate change is projected to impact the distribution of deep-sea species including commercially important fishes and foundation species. In the North Atlantic, deep-sea fish species with the best-studied distributions could experience a significant reduction in suitable habitat by 2100 as a result of climate change. Results suggest that the suitable habitat of scleractinian corals in the North Atlantic may be reduced by more than 50%, potentially extirpating all three octocorals studied. The results also highlight the importance of identifying and preserving climate refugia for a range of area-based planning and management tools.[28]

24 Hoegh-Guldberg. O., et al. 2019. "The Ocean as a Solution to Climate Change: Five Opportunities for Action." Report. Washington, DC: World Resources Institute. Available online at http://www.oceanpanel.org/climate

25 Levin, L.A. et al. 2020. Climate Change Considerations are Fundamental to Management of Deep-Sea Resource Extraction Global Change Biology. 2020;00:1–15. DOI: 10.1111/gcb.15223; Levin LA (2021) IPCC and the Deep Sea: A Case for Deeper Knowledge. Front. Clim. 3:720755. doi: 10.3389/fclim.2021.720755.

26 Levin et al, 2021.

27 Ibid.

28 Morato, T. et al. 2020. Climate-induced changes in the suitable habitat of cold-water

Coastal blue carbon ecosystems, such as seagrasses, mangroves, kelp beds and tidal marshes have increasingly been recognized for their contribution to climate change mitigation through sequestering excess CO_2 from the atmosphere. Less attention has been paid to blue carbon in open ocean and deep-sea ecosystems, which also sequester considerable amounts of CO_2. Dissolved organic carbon is ~70% of the total organic carbon in the ocean, and most of it is found at depths >1, 000 m where this carbon remains out of contact with the atmosphere for thousands of years. Collectively, more attention needs to be paid to the contribution of marine ecosystems to climate change mitigation by focusing on the importance of conserving existing marine pathways of carbon fixation, transport, burial and sequestration.[29] Challenges associated with the measurement, valuation, management, and governance of carbon in coastal, open ocean, and deep-sea ecosystems are highlighted in section 2.3 on knowledge gaps. Blue carbon and associated policies are discussed in more detail in section 4 on mitigation.

Scientific studies have demonstrated that ocean acidification threatens both tropical and deep-sea coral reefs. In recent research on cold water coral reefs,[30] based on in situ observations and laboratory evidence, ocean acidification caused increased reef porosity that resulted in crumbling of critical structural sections of the coral framework. This has the potential to reduce the complex 3-dimensional structure of reefs, leading to rapid ecosystem-scale habitat loss in the near future, and threatening the biodiversity that reefs support. This process leading to a shift from one habitat type (high complexity with high biodiversity support) to another (low complexity with low biodiversity support), is generally very different from the processes described in tropical corals, where the main threat is a change in growth rates of live coral combined with greater bioerosion. In both systems, loss of biodiversity supported by the reef is predicted.

There is evidence that a substantial increase in effective ocean protection could provide joint benefits to biodiversity, food security (through increased fisheries yields), and securing marine carbon stocks that are at risk from human activities. Marine sediments are the largest pool of organic carbon on the planet, and a crucial reservoir for long-term storage, but are at risk from bottom trawling and other industrial activities that could re-mineralize sedimentary CO_2 and as a result could increase ocean acidification and reduce the buffering capacity of the ocean. Strategic conservation planning has been proposed as an approach for reconciling biodiversity, fisheries and carbon storage objectives for MPAs at both global and national scales.[31]

2.3 Remaining knowledge gaps for action

Knowledge gaps on the impacts of climate change and adaptation and mitigation efforts remain in multiple areas.

Ocean Science

Many knowledge gaps exist in the ocean concerning the changes occurring (rarely monitored in deep water or remote locations) and the consequences of those changes for ocean ecosystems and their contributions to human communities—including the services and species they reply upon. There are even more fundamental gaps in understanding deep-sea processes (including climate change impacts on deep-sea living marine resources and habitats)[32] and coastal processes, bentho-pelagic coupling and biogeochemical cycles and feedbacks needed to groundtruth earth system models and accurately project environmental change (e.g., for deoxygenation, ocean acidification, increasing seawater temperature) under different emissions scenarios.[33]

We need a firm understanding of marine species tolerances and thresholds to climate variables, including to multiple stressors, traits that exacerbate climate vulnerability, the consequences of changing species distributions and interactions, how these translate into altered ecosystem function and the implications for ecosystem services. This knowledge can underpin social and economic vulnerability assessments, climate adaptation and resilience strategies as well as carbon conservation efforts that maintain carbon sequestration and protect biodiversity.[34] Elucidating the interaction of climate change with other human disturbances from development, extraction of living and non-living resources, pollution or species invasion, and ocean-land interactions, will require better data, technological advances and modeling innovations, and sustained capacity building, all of which will be necessary for sustainable management of ocean resources and biodiversity conservation.[35]

The ocean is recognized as a critical climate mitigator, and there is growing interest in adopting nature-based ocean sequestration solutions as negative emission ac-

corals and commercially important deep-sea fishes in the North Atlantic. Global Change Biology. DOI: 10.1111/gcb.14996

29 Hilmi N, Chami R, Sutherland MD, Hall-Spencer JM, Lebleu L, Benitez MB and Levin LA (2021) The Role of Blue Carbon in Climate Change Mitigation and Carbon Stock Conservation. Front. Clim. 3:710546. doi: 10.3389/fclim.2021.710546.

30 Hennige S.J., Wolfram U., Wickes L., Murray F., Roberts J.M., Kamenos, N.A., Schofield S., Groetsch A., Spiesz E.M., Aubin-Tam M.E., Etnoyer P.J. (2020). "Crumbling Reefs and Cold-Water Coral Habitat Loss in a Future Ocean: Evidence of "Coralporosis" as an Indicator of Habitat Integrity." Frontiers in Marine Science 7, pp.1-16..

31 Sala et al, 2021.

32 FAO 2018.

33 Bianchi, TS, et al. 2021. What global biogeochemical consequences will marine animal–sediment interactions have during climate change?. Elem Sci Anth, 9: 1. DOI: https://doi.org/10.1525/elementa.2020.00180

34 Levin 2021.

35 Quieros et al. 2021; Levin et al. 2020.

tions, but many questions about the approach remain. The restoration of coastal blue carbon ecosystems (seagrasses, mangroves, tidal marshes) is worthwhile for the many ecosystem services they provide; however, climatic benefits are modest and affected by many uncertainties.[36] There may also be scope for climatically-significant seaweed cultivation (for use as a biofuel, linked with carbon capture and storage), although large areal coverage would be needed. The role, magnitude and state of other carbon stores (e.g. carbon-rich coastal and shelf sea sediments) and the impact of human activities, such as bottom trawling and dredging, on them have been less well researched but may be significant.[37]

For other nature-based climate interventions (e.g., macroalgal and terrestrial biomass sinking, alkalinity additions, CO_2 storage in the seabed and other geoengineering approaches at climate-relevant scales there is a nearly complete absence of knowledge about deep-water impacts, ecological side effects, and overall effectiveness. The effects of fish harvest, bottom trawling, whaling, pollution, assisted evolution or other activities on the carbon fluxes, release and sequestration are also important for climate-smart ocean management. For all of these we require a better understanding of the biological pump, connectivity between the ocean carbon cycle and the cycles of oxygen and nutrients and how multiple stressors affect ocean carbon dynamics.[38]

Economic protocols are needed with due consideration to non-market values[39] including: 1) Criteria and standardized methodologies, particularly on relevant time scales for carbon accounting in blue carbon ecosystems and assessment of the financial value (returns) of creation and restoration; these could enable a role for economics in prioritizing projects; 2) Financial valuation of the interconnected ecosystem services provided by blue carbon ecosystems to create a systematic and holistic toolkit that includes co-benefits, with accessibility and utility to non-experts; 3) Weighing economic benefits of carbon dioxide sequestration against the cost of methane and nitrous oxide emissions in blue carbon ecosystems; and 4) Accounting for the transboundary fluxes of carbon, such as occur across jurisdictions and in MPAs.[40]

36 Karim, L Levin, S O'Donoghue, SR Purca Cuicapusa, B Rinkevich, T Suga, A Tagliabue, P Williamson . Chapter 5. Changing Ocean, Marine Ecosystems, and Dependent Communities. In IPCC Special Report on the Ocean and Cryosphere in a Changing Climate [H.-O. Pörtner, DC Roberts, V. Masson-Delmotte, P. Zhai, M. Tignor, E. Poloczanska, K. Mintenbeck, A. Alegría, M. Nicolai, A. Okem, J. Petzold, B. Rama, NM Weyer (eds.)], 2019.
37 Sala et al. 2021
38 IOC 2021.
39 Watkiss et al., 2019.
40 Hilmi et al. 2021.

Research and mitigation process at ocean-basin and regional scales

Information on the dynamic physical, chemical and biological status of the global ocean is crucial to understanding climate change including its impacts to date, how those might change in future, and what responses will be most effective. Ocean observing systems over a range of water depths and spatial scales also provide operational data for shipping, greatly improve weather forecasts, support effective conservation, and facilitate the sustainable use of marine resources. To track the ongoing effects of climate change on the ocean, and the ocean's role in climate change, requires an efficient observing system for the global open and deep ocean and for regional seas, taking advantage of modern technologies such as satellites and autonomous observing platforms, and supported by state-of-the-art modelling systems. Polar regions may require focused efforts in light of their central role as carbon sinks and their high vulnerability to climate change.[41]

There is a need for novel technology (sensors, artificial intelligence), stepped-up intercalibration and validation efforts, high engagement by and collaboration among participating countries and the private sector, and sustained adequate funding.[42] Currently most ocean observations are supported by short-term research funding, making them vulnerable to interrupted data records and so leaving key gaps in critical observations. Moving these observations to a more sustained footing will require international will and cooperation.[43]

Due to the hyper-connectivity of ocean ecosystems, we need to scale-up our research to ocean-basin scales over longer timeframes to understand the impacts and design appropriate adaptation and mitigation strategies, as well as early warning models and indicators. For instance, to develop effective mitigation processes against the material loss and habitat crumbling of coral reefs we will need repeated measure studies on live and dead coral, and refined models are needed to identify local sources of stress as well as tipping points of coral habitat loss and develop powerful monitoring tools.[44] Only by understanding our vast ocean - alongside the local, coastal stressors that contribute to ecosystem and species decline - will we ultimately be able to support 'future conservation and management efforts of these vulnerable marine ecosystems by indicating which ecosystems are at risk, when they will be at risk, and how much of

41 IOC 2021.
42 Ibid.
43 Levin et al. 2019; Turley et al. 2021.
44 Hennige et.al, 2020.

an impact this will have upon associated biodiversity'.[45]

For example, by conducting ocean-basin scale research, researchers in Ghana and the UK are able to develop ecosystem and fish stock assessment models to assess and identify fish stocks of economic and social importance (sea breams) that are at risk from a number of cumulative factors, including climate change.[46] These findings informed the design of community fieldwork to elicit views of the Elmina fishing community on the cause of reduced stocks, and community observation of changes in catch size, and catch locations. This iterative research process with the community, allows local knowledge to inform science, and science to be fed back to the community and the co-development with government departments (Ghana's Environmental Protection Agency and Fisheries Commission), a new geo-meta database, to provide a common data depository available in-country to address issues of disconnects between agencies responsible for managing marine biodiversity.

In South Africa, with input from the Department of Forestry, Fisheries and Environment (DFFE), ocean-basin scale research enables researchers in modeling and developing climate scenarios for fisheries, for the southern Benguela system.[47] This research contributes to the co-production (with the local municipality) of an online tool to assess the ability to respond to climate change through human, legal/policy, and environmental resources, by integrating social sciences, climate science, conservation biology, social-ecological systems, and ecology.

Ocean Change Science for Decision Making

The West Coast of North America is acidifying twice as fast as anywhere else in the world.[48] In the early 2000s, increased acidification resulted in the death of baby oysters in hatcheries and significantly disrupted the shellfish aquaculture industry (Barton, A., 2012). Low-oxygen conditions have led to extended periods of hypoxia, stressing a wide range of marine animals from crabs to fish. In 2014 and 2015, the region experienced a marine heatwave known as "the blob" covering more than 3.5 million square miles from Mexico to Alaska, an area larger than the contiguous United States. During the blob event, regional ocean temperatures increased more than 3 degrees Celsius and triggered the largest toxic algal bloom ever recorded in the Pacific Northwest - the resulting closure of commercial crab fisheries and recreational razor clam fisheries cost communities hundreds of millions of dollars.

Coordinating science for decision making at regional and local scales has helped prioritized key data and knowledge gaps for management response. Between 2013-2016 the West Coast Ocean Acidification and Hypoxia Science Panel[49] was convened which synthesized scientific understanding and recommended a series of local and regional strategies for addressing the challenge, such as coordinated investments in regional monitoring to create a basis for evaluating actions. State governments in the region then took up a West Coast Ocean Acidification and Hypoxia Assets Inventory which was completed in 2018 in partnership with academia and state, provincial, and federal governments. The inventory sets the stage for informing additional priorities and strategic investments.[50]

The United States National Oceanic and Atmospheric Administration (NOAA) supports regional Coastal Acidification Networks (CANs) that specialize in compiling, advancing, and disseminating scientific assessments and convene diverse groups of interdisciplinary researchers, Tribal, federal, and state agency representatives, resource managers, and industry partners to support regional coordination. Governments look to regional CANs as critical partners in defining and advancing state-led efforts, as well as leverage existing knowledge.[51] Ongoing engagement with regional networks can institutionalize monitoring programs and generate long-term datasets needed to understand and better anticipate ocean change conditions and impacts. A coordinated approach with in-region academic institutions can help a government prioritize gaps and secure funding from a variety of sources. Regional activities should expediate processes or avoid unnecessary duplication.

NOAA is also supporting funding for three regional vulnerability assessments that explore the social and economic vulnerabilities associated with ocean and coastal acidification impacts. More ocean change regional vulnerability assessments will be needed to help identify and prioritize localized adaptation and resilience strategies that are most responsive to local conditions and contexts.

In regards to ocean science for decision-making, the Ocean Decade is bringing together scientists with stakeholders from all aspects of the ocean-value chain to develop solutions-based science targeted at these ocean

45 Hennige et.al, 2020; see also Morato, 2020, and Sweetman et al. (2017) "Major impacts of climate change on deep-sea benthic ecosystem." Elementa 5:4, pp. 1-23:
46 Cook, Acheampong, Aggrey-Fynn and Heath, "A Fleet-based Surplus Production Model that Accounts for Increases in Fishing Power with Application to Two West African Pelagic Stocks" (2021) Fisheries Research, https://doi.org/10.1016/j.fishres.2021.106048
47 Ortega-Cisneros et al. 2021. Assessing South Africa's potential to address climate change impacts and adaptation in the fisheries sector. Frontiers in Marine Science 648, https://doi.org/10.3389/fmars.2021.652955
48 Osborne, E.B.,

49 Chan, F., 2016
50 Turner, J., 2021.
51 Cross., 2019.

science gaps and societal needs. The knowledge generated from these actions will be used to inform global policy frameworks, including the UNFCCC, CBD, BBNJ, Sendai framework and SAMOA Pathway.

Adaptation monitoring and evaluation

The implementation of adaptation actions to address climate change impacts on marine ecosystems and coastal communities has started to take place on the ground, but given the magnitude and speed of changing climate and ocean conditions, there are relatively few intentional, well-documented examples of tactical adaptation actions at all levels from individuals to national policies.[52] It should also be noted that tracking progress and evaluating success of climate change adaptation is a relatively recent yet expanding field. Despite several available initiatives, guidelines, frameworks and tools launched at the national and global level, their practical use is largely constrained by either the absence of adequate baseline information or the fact that they are often project-specific therefore contributing only partially to policymaking at the national level.[53] As a result, the evaluation of adaptation success in the context of ocean ecosystems remains generally lacking in practice.[54]

Recognizing the complex nature of adaptation processes, more research efforts are needed to better understand the interrelationships of climate change impacts, marine living resources and habitats, ocean economic activities (including marine fisheries and aquaculture), as well as institutional and policy systems that drive adaptation processes and outcomes in context-specific situations at the national and local level. Repeated and frequent monitoring and evaluation of the effectiveness of adaptation action to make improvements are also recommended even if starting without a perfect framework and methodology. For example, better monitoring to assess changes in life-history parameters of fish populations and targeted research and monitoring of climate-related impacts to directly inform management processes are needed to support effective implementation of marine fisheries management systems.[55] A number of newly-endorsed UN Decade for Ocean Science programs address enhanced access to quality data and information to produce regional and local data products needed for adaptation and mitigation measures, including GOOD, OARS, Coastpredict, Marine Life 2030 and DOOS.

52 Bell et al. 2020.
53 FAO, 2017.
54 Bahri et al. 2021.
55 Ibid.

Inter- and trans-disciplinarity research on the nexus of climate change, oceans, biodiversity, and human rights

Given the complexity of the challenges, we will need to bring together different stakeholders and experts from different disciplines, including social sciences (See Decade for Ocean Science Challenge 5). Research on the behaviour and resource use of coastal and riverine communities in response to temperature change is important for climate change analysis on aquatic systems.[56] There is a need to define a human rights-based approach to climate change adaptation and mitigation, mainly with regard to the rights and role of Indigenous Peoples and local communities.[57] Discussion on the importance of intangible heritage of the oceans, particularly to Indigenous Peoples and local communities for instance, has been largely overlooked in discussion about climate change. This is despite the alignment between science and indigenous knowledge. An original animated film, *Indlela yokuphila*[58] (isiZulu for "the soul's journey"), which brought together artists, traditional healers, marine sociologists and deep-sea marine ecologists capture this alignment particularly well.

Adaption to the rapid and vast changes to the ocean, driven by climate change, and how people relate to them culturally and spiritually, will be essential to maintain the services and values that the ocean provides.[59] Indigenous Peoples and local communities also play a crucial role in climate change adaptation and mitigation since climate change is a global phenomenon, but its effects are often experienced at local levels. There is a need to integrate community-level assessments of vulnerability to climate change and impacts on their well-being to inform decision making in areas such as marine spatial planning or the alternative and supplementary livelihoods.[60] Substantial investments in sustained endogenous capacity building for emerging and existing scientists, especially in developing countries, will be necessary to develop the workforce with the capacities to close these knowledge gaps, and to create locally and globally appropriate responses to the multiple ocean stressors.

56 Fiorella, et al. 2021; Colburn L.L. et al., 2016.
57 Morgera, E. (2013). "No Need to Reinvent the Wheel for a Human Rights-Based Approach to Tackling Climate Change: The Contribution of International Biodiversity Law" in Hollo, Kulovesi and Mehling (eds.), Climate Change and the Law (Springer) 350-390; Morgera, E. (2018-19). "Fair and equitable benefit-sharing in a new international instrument on marine biodiversity: A principled approach towards partnership building?" 5 Maritime Safety and Security Law Journal 48-77
58 https://www.youtube.com/watch?v=AAy0RDSido0.
59 Kira Erwin, 2 April 2020; McDonald, 27 January 2021.
60 Sowman, "Participatory and Rapid Vulnerability Assessments to Support Adaptation Planning in Small-scale Fishing Communities of the Benguela Current Large Marine Ecosystem" (2020) Environmental Development, https://doi.org/10.1016/j.envdev.2020.100578.

The UN Decade of Ocean Science for Sustainable Development (the Ocean Decade) with its focus on co-designed, solutions-oriented science will provide a framework to convene diverse actors across geographical scales, disciplines and knowledge systems to facilitate the generation of critically needed knowledge.[61] The Ocean Decade will use information on critical science gaps to tailor Calls for Decade Actions to meet Ocean Decade Challenges, including a specific challenge on the ocean-climate nexus.

61 IOC-UNESCO, 2020.

OceanImageBank_TheOceanAgency_

3. THE CENTRAL ROLE OF NATIONALLY DETERMINED CONTRIBUTIONS AND OTHER NATIONAL TOOLS FOR OCEAN-CLIMATE ACTION

This section discusses national-level action on ocean-based climate solutions, in particular in the context of NDCs and efforts to further improve their ocean-related content, as discussed in section 3.1. New and updated NDCs, submitted as part of the first revision cycle mandated by the Paris Agreement, are a key opportunity for countries to consider connections between the ocean and climate, and to set goals and plans for ocean and coastal nature-based solutions to climate change. In addition, some countries have further harmonized national level planning on ocean and climate, and this section also provides an example[62] of how National Ocean Policies (NOPs) could be used as a tool to create synergies in national-level ocean-climate action, and to consider the ocean in the context of NDCs and national climate policies (3.2). National actions related to mitigation are further discussed in section 4, while adaptation actions are discussed in section 5.

3.1 Actions to further improve ocean content of NDCs

In a context of growing attention given to ocean-related measures in climate strategies, the Ocean & Climate Platform, IUCN, Conservation International, Rare, together with a group of conservation Organizations, joined forces to analyse coastal and marine ecosystems as Nature-based Solutions in new or updated NDCs. The final analysis will be published on the Ocean & Climate Platform's website[63] in advance of UNFCCC COP 26.

Coastal and marine ecosystems have significant carbon sequestration and storage capacity,[64] and provide a range of benefits in helping coastal populations adapt to a changing climate.[65] The protection, restoration and conservation of these vital ecosystems represent effective ocean-based climate solutions to contribute to achieving emission reduction plans and building resilience in line with the Paris Agreement.

In that regard, coastal and marine Nature-based Solutions (NbS) (i.e. actions to protect, sustainably manage and restore coastal and marine ecosystems in ways that address societal challenges effectively and adaptively) provide significant opportunities in terms of climate mitigation, adaptation and resilience, both for nature and people.[66] For instance, services provided by mangrove habitats to human livelihoods are estimated to be worth at least $US 1.6 billion annually[67]- which is quite substantial.

The analysis examines the new or updated NDCs, submitted as part of the first revision cycle, with regard to the inclusion of specific efforts addressing coastal and marine NbS as climate mitigation and/or adaptation measures. It also provides details on how countries have included enabling conditions to effectively implement these NbS (e.g., capacity-building, finance, monitoring). Finally, it provides a robust comparison between first NDCs and updated NDCs, showcasing whether countries have increased, renewed, contained or decreased their ambition between first and second submissions.

The first revision cycle of NDCs offers a great opportunity for Parties to the Paris Agreement to update, assess and review their national climate commitments, as each successive NDC is required to showcase increased ambition compared to the previous submission (Article 4.3 of the Paris Agreement).[68] As a result, this revision cycle is also an opportunity to raise Parties' ambition and make greater use of coastal and marine NbS in their respective strategies and actions.

In the first NDCs, 44 out of 91 countries[69] included coastal and marine NbS for mitigation and/or adaptation purposes. In comparison, 55 out of 91 countries included relevant coastal and marine NbS their updated NDCs.

The comparative analysis therefore suggests an overall increase in countries' level of ambition with regards to coastal and marine NbS for climate mitigation and adaptation.[70] Half of the countries that submitted their updated NDCs have increased their ambition in comparison to their first NDC. Out of 91 countries, 47 added new coastal and marine NbS for either mitigation or adaptation purposes between their two submissions. For instance, Belize added measures to maintain and enhance the carbon storage functions of natural carbon

62 https://ocean-climate.org/wp-content/uploads/2021/06/coastal-and-marine-ecosystem-2806.pdf

63 Available at https://ocean-climate.org/en/home-2/

64 IPCC (2019). Summary for Policymakers. In: Special Report on the Ocean and Cryosphere in a Changing Climate (H.-O.P rtner, D.C. Roberts, V. MassonDelmotte, P. Zhai, M. Tignor, E. Poloczanska, K. Mintenbeck, A. Alegr a, M. Nicolai, A. Okem, J. Petzold, B. Rama, N. M. Weyer (eds.)). Available at: https://www.ipcc.ch/srocc/

65 ibid

66 Narayan, S., et al. (2016). The Effectiveness, Costs and Coastal Protection Benefits of Natural and Nature-Based Defences. Available at: https://doi.org/10.1371/journal.pone.0154735

67 Magnan, A.K. et al. (2018). Ocean-based measures for climate action. IDDRI, Policy Brief N°06/18. Available at: https://www.iddri.org/sites/default/files/PDF/Publications/Catalogue%20Iddri/Propositions/201810-PB0618-oceans%20solutions_0.pdf

68 Fransen, T., et al. (2019), Enhancing NDCs: A Guide to Strengthening National Climate Plans by 2020, Washington, DC: World Resources Institute. Available at: https://www.ndcs.undp.org/content/ ndc-support-programme/en/home/impact-andlearning/library/ndc-enhancement-guide0.htm

69 As of 4 October 2021, the comparative analysis covers the 90 countries and the EU-27, hereafter 91 countries, that have submitted both their first and updated NDCs (i.e., in total 117 countries).

70 A country is considered to have increased its ambition when it added new coastal and marine NbS, i.e. when it included coastal and marine NbS as part of their mitigation and/or adaptation measures in updated NDCs, but did not include it in INDC or first NDC.

sinks, protecting and restoring mangroves and seagrasses (i.e. removing a cumulative total of 381 $KtCO_2e$ between 2021 and 2030 through ecosystem restoration), in its updated NDC.

This increase in ambition primarily results in countries further including the ocean in their updated NDCs, i.e. further recognising the pressures weighing on the ocean as well as threats coming from ocean changes. Compared to the first NDC submissions, 11 out of 91 countries have added references to ocean changes (e.g. acidification) and/or climate impacts (e.g. sea-level rise) in their updated NDCs.

In addition, this increase in ambition also results in new measures to implement coastal and marine NbS for mitigation and/or adaptation purposes in updated NDCs. 59 countries have included coastal and marine NbS in their updated NDCs. For instance, Cambodia identified the need to enhance adaptation and build resilience of the fisheries sector. Cambodia undertook to reduce pressures on fishing resources, and to develop aquatic habitats, as well as climate-smart aquaculture production systems and practices.

It is worth noting that countries also added specific and quantifiable targets to support the implementation of these measures in their updated NDCs. Overall, 20 countries have increased their ambition, adding new quantitative targets to support the implementation of quantifiable coastal and marine NbS for mitigation and/or adaptation (e.g. percentage of coastal wetlands under protection). For example, in its updated NDC, Nigeria expressed its intention to protect and restore mangrove forest ecosystems, including 13,012 hectares (Ha) of mangroves across all the coastal states in the Niger Delta.

While a growing number of countries include coastal and marine NbS in their NDCs, countries have also recognized the challenges they face in order to implement their commitments, especially in light of the current situation with the COVID-19 pandemic and resulting economic crisis. Nonetheless, viable and immediate opportunities exist to overcome such challenges. For instance, all blue carbon countries - even those countries with limited technical knowledge of the ecosystems' scale or carbon value - have the chance to act and include coastal wetlands in their NDCs.[71,72]

Through conservation, restoration and sustainable management of coastal and marine ecosystems, countries have the opportunity to increase ambition towards achieving the Paris Agreement long-term goals, while building resilience along their coastlines, and securing a future for coastal biodiversity, food security, and livelihoods, thereby also meeting global sustainable development and biodiversity goals.

3.2 National Ocean Policies as a tool for further integrating ocean and climate action

The latest NOPs take stock of climate change policies and issues. They also provide a tool for integrating NDCs and climate policies with ocean policies. Fiji provides an important example of this approach.

Fiji's NOP follows the National Climate Change Policy 2018-2030. It highlights Fiji's actions to mitigate national emissions through its NDCs and National Climate Change Policy, and highlights rapid global reduction of GHG emissions as vital for the long-term sustainability of the ocean. It also notes that the scope of the NOP extends to climate change and associated impacts, such as ocean acidification. Further, Fiji's recently adopted climate change bill, which passed into law on 26 September 2021, specifically references the NOP and includes a section on 'oceans and climate change'. Importantly, it calls to: "ensure that climate-related policies and measures adequately integrate consideration of oceans through safeguarding and enhancing the ability of oceans to respond to the adverse impacts of climate change and taking advantage of the mitigation potential of oceans" [article 4 (o)]; consider the NOP along with other relevant policies when preparing successive NDCs; and calls to "enhance environmental protection of land and ocean carbon sinks" [article 43 (d)]. Also this Act "recognises the permanence of Fiji's maritime boundaries and maritime zones and maintains the rights and entitlements that flow from Fiji's maritime zones" [article 80]; and sets Fiji's long term ocean sustainability target [article 81].

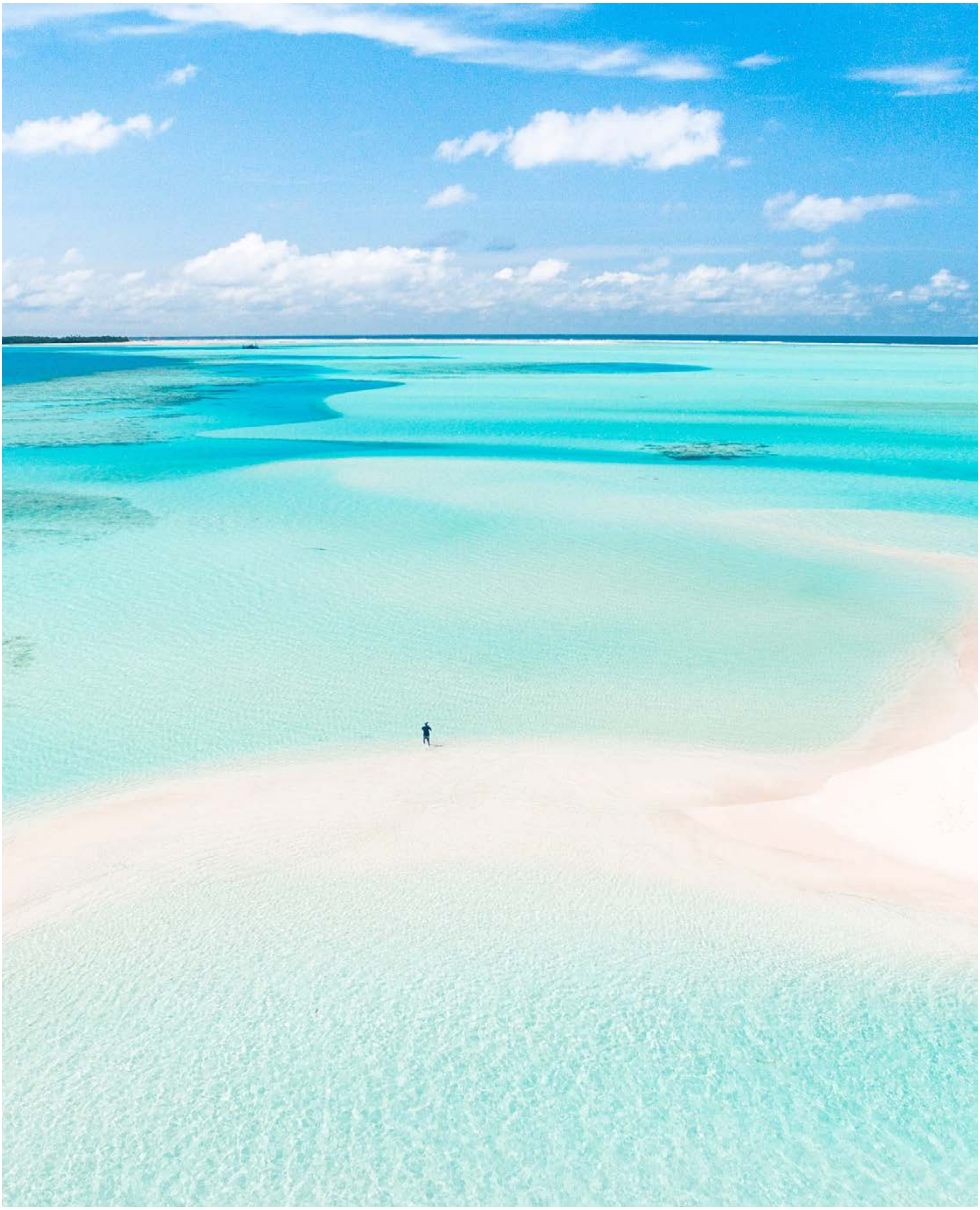
3.3 Summary of achievements

The discussion in this section has demonstrated a rising ambition in the inclusion of coastal and marine NbS in NDCs. The section has demonstrated that through conservation, restoration and sustainable management of coastal and marine ecosystems, countries have the opportunity to increase ambition towards achieving the Paris Agreement long-term goals, while at the same time also meeting other national priorities, including for sustainable development goals. This section has also showcased national-level innovation in creating synergies in ocean and climate action. Further detail on

71 The Blue Carbon Initiative (2021). Guidelines for Blue Carbon and Nationally Determined Contributions.
Available at: https://www.thebluecarboninitiative.org/

72 Information regarding the management of coastal and marine ecosystems for adaptation can be found here.

national-level mitigation and adaptation measures, including in the context of NDCs, are provided in the next two sections.



OceanImageBank_Ishan Hassan

4. MITIGATION

Section 4 of this report focuses on mitigation measures, based on the following Roadmap recommendations: *Further develop and apply mitigation measures using the oceans, such as implementing "Blue Carbon Policies," reducing CO_2 emissions from ships, developing ocean-based renewable energy, and considering (long-term no-harm) ocean-based carbon capture and storage. Encourage all nations to reduce CO_2 emissions so that the Paris Agreement to limit emissions to well below 2 C can be achieved, ideally holding to 1.5 C'.*

In particular, this section will focus on blue carbon and nature-based solutions (section 4.1), reducing CO_2 emissions from shipping (section 4.2), ocean-based renewable energy (section 4.3) and ocean-based carbon capture and storage (section 4.4).

4.1 Implementing "blue carbon" policies and "nature-based solutions"

Nature-based Solutions (NbS)[73] for addressing climate mitigation and adaptation have become increasingly prominent strategies for climate mitigation. Mitigation actions through management interactions (conservation and/or restoration) in the coastal and marine ecosystems are often referred to as "blue carbon".

Coastal blue carbon ecosystems – mangroves, seagrasses and tidal marshes – can sequester and store more carbon per unit area than terrestrial forests[74] and are recognized for their climate mitigation value by the IPCC.[75] These blue carbon ecosystems are already included in some countries' NDCs to the Paris Agreement, national GHG Inventories, and other climate mitigation mechanisms. Coastal blue carbon ecosystems also provide numerous other services – e.g. coastal protection, nurseries for fish – which are applicable to climate adaptation policies, such as NAPs. New reports by UNEP[76] and the United Nations Educational, Scientific and Cultural Organization (UNESCO)[77] emphasize that protecting and restoring these ecosystems not only contributes to climate change mitigation and adaptation, but also to achieving several national targets in relation to the SDGs.

Due to the COVID-19 pandemic, the first revision of the NDCs of the Parties to the Paris Agreement, which was initially expected in March 2020, was delayed, and Parties can now submit their NDCs ahead of the UNFCCC COP26, scheduled to take place on 1-12 November 2021.

International efforts to increase countries' commitments towards blue carbon ecosystems are led by the International Partnership for Blue Carbon (IPBC), launched at UNFCCC COP21 (Paris, France, 2015) by nine founding partners. In 2021, the Partnership has 48 Partners, of which 17 are country government agencies. The Partnership is coordinated by the Australian Government with the support of IOC-UNESCO (see Box 1).

At the national level, highlights from the Western Indian Ocean include Kenya, with its National Mangrove Ecosystem Management Plan (2017-2027), and Madagascar, which has started the elaboration of a national mangrove strategy (*stratégie nationale de gestion intégrée de l'écosystème de mangrove à Madagascar)* with effective involvement of stakeholders and good collaboration between ministries. Mozambique, for its part, is at an advanced stage of developing its Marine Spatial Plan (POEM), in which key areas for mangrove protection were taken into consideration. This is an integral part of the implementation of the National Mangrove Management Strategy approved in 2020, where the Mozambique's government has prioritized its mangrove and coastal areas in policy. The mangrove-related efforts in the Western Indian Ocean are partly supported by the Save our Mangroves Now (SOMN) initiative.

In regards to conservation, successful projects are being implemented globally, with a few projects offering carbon credits. In May 2021, the Blue Carbon Project in Gulf of Morrosquillo in Colombia was registered under the Verra standard.[78] The project – developed by Conservation International (CI) with the technical support of South Pole, using a Verra methodology – will sequester almost one million tonnes of carbon dioxide over 30 years by conserving and sustainably managing 7,561 hectares of coastal mangrove ecosystem, marshes, and associated streams. This project adds to the few other blue carbon offset projects. One of these is the mangrove conservation project in Vanga Bay, Kenya,[79] verified by the Plan Vivo carbon trading standard. It builds on the success of a similar project in Gazi, a community just a few kilometers north, which has been trading mangrove carbon credits on the Voluntary Carbon Market since 2012.[80]

The Blue Forests Project – an initiative of UNEP, funded by the GEF, co-financed by project partners, and

73 Nature-based Solutions definition (Resolution WCC-2016-Res-069-EN)
74 Mcleod, E., Chmura, G.L., Bouillon, S., Salm, R., Björk, M., Duarte, C.M., Lovelock, C.E., Schlesinger, W.H. and Silliman, B.R., 2011. A blueprint for blue carbon: toward an improved understanding of the role of vegetated coastal habitats in sequestering CO_2. *Frontiers in Ecology and the Environment*, 9(10), pp.552-560.
75 IPCC 2014, 2013 Supplement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Wetlands, Hiraishi, T., Krug, T., Tanabe, K., Srivastava, N., Baasansuren, J., Fukuda, M. and Troxler, T.G. (eds). Published: IPCC, Switzerland.
76 United Nations Environment Programme (2020). Out of the blue: The value of seagrasses to the environment and to people. UNEP, Nairobi.
77 UNESCO. 2020. UNESCO Marine World Heritage: Custodians of the globe's blue carbon assets. Paris, France.

78 https://verra.org/press-release-verra-has-registered-its-first-blue-carbon-conservation-project/
79 https://www.planvivo.org/vanga
80 https://www.planvivo.org/mikoko-pamoja

Box 1. International initiatives on blue carbon

The Blue Carbon Initiative

The Blue Carbon Initiative (BCI) is a global program working to mitigate climate change through the restoration and sustainable use of coastal and marine ecosystems. Coordinated by Conservation International, IUCN and IOC-UNESCO, the BCI works through a Science and a Policy working group. The International Blue Carbon Scientific Working Group identifies priority research areas, synthesizes current and emerging blue carbon research and provides a robust scientific basis for coastal carbon conservation, management and assessment. The International Blue Carbon Policy Working Group supports efforts to integrate blue carbon into existing international policy frameworks such as the UNFCCC and the CBD, among others.

Key resource: A manual for measuring, assessing and analyzing coastal blue carbon.

International Partnership for Blue Carbon

The International Partnership for Blue Carbon (IPBC) builds awareness, shares knowledge and accelerates practical action on blue carbon protection by connecting governments with blue carbon practitioners and scientists. Partners include government agencies, non-governmental organizations, regional organizations and scientific institutions that share the vision to protect, restore and sustainably manage global blue carbon ecosystems – contributing to climate change mitigation, adaptation, biodiversity, ocean economies and livelihoods of coastal communities. The diversity and expertise of Partners is a fundamental strength and enables the Partnership to be recognized as a source of credible information, tools and guidance. The Blue Carbon Initiative and its technical network serve as advisors to the Partnership.

Key resource: A factsheet on: Incorporating coastal wetlands in inventories

Global Mangrove Alliance

The goal of the Global Mangrove Alliance is to increase the global area of mangrove habitat through conservation, restoration and equitable management. To meet this goal, the Alliance utilizes the collective expertise of its members to connect and coordinate diverse initiatives into a global portfolio that leverages and amplifies best practices and pursues conservation and restoration opportunities. The Alliance is currently coordinated by CI, IUCN, The Nature Conservancy, Wetlands International and the World Wildlife Fund.

Key resource: A report on the state of the world's mangroves

managed by GRID-Arendal, is currently supporting on-the-ground activities in Ecuador[81](with lead partner Conservation International–Ecuador), Madagascar[82] (with lead partner Blue Ventures), Mozambique[83] (with lead partner WWF), and the United Arab Emirates[84] (with lead partner Abu Dhabi Global Environmental Data Initiative).

The Blue Natural Capital Financing Facility (BNCFF), managed by IUCN, is also supporting three large-scale blue carbon projects as follows[85]:

- Forest Carbon in Indonesia, protecting 18,000 hectares of mangrove forests;
- Terra Global Capital in Zanzibar, protecting 16,900 hectares of mangrove forests; and
- Wildlife Conservation Society in Kenya, protecting and generating for the first time carbon credits from 300 hectares of seagrass.

IUCN's LIFE Blue Natura project in the Mediterranean quantifies the carbon deposits and the sequestration rates of seagrass meadows and marsh habitats in Andalusia, Spain, while also addressing legal, policy and financing questions which can facilitate the enabling frameworks for the protection and conservation of this important habitat.

From a scientific perspective, research efforts are increasingly directed towards emerging blue carbon ecosystems, such as macroalgae (including kelp and seaweed farms), benthic sediments and mud flats.

4.2 Reducing CO_2 emissions from ships

Carrying more than 80% of the international trade of goods in volume, international shipping has increased fourfold over the past 50 years to a total of 11 billion tonnes which makes it the main pillar of global commerce. As such and as a global network connecting States, shipping has a key role to play in the development of a sustainable economy.

The IMO is a specialized United Nations agency and the global standard-setting authority for the safety, security and environmental performance of international ship-

81 https://gefblueforests.org/project/ecuador-site/
82 https://gefblueforests.org/project/madagascar-site/
83 https://gefblueforests.org/project/mozambique-site/
84 https://gefblueforests.org/project/united-arab-emirates/
85 https://bluenaturalcapital.org/campaigns/blue-carbon/

ping. Its main role is to create a regulatory framework for the shipping industry that is fair and effective, universally adopted and universally implemented.

For over a decade now, the IMO has been committed to cutting GHG emissions from ships. Shipping is the most cost-effective and energy efficient mode of mass cargo transport, and since 2009 the increase of CO_2 emissions of international maritime transport has been effectively decoupled from the continuously growing global seaborne trade volume. However, the Fourth IMO GHG Study 2020 estimated that carbon dioxide emissions from international shipping still accounted for between 2% and 2.5% of global anthropogenic emissions (being voyage-based and vessel-based allocations respectively).

In 2018, Member States adopted the Initial IMO Strategy on reduction of GHG emissions from ships (resolution MEPC.304(72)), setting out IMO's commitment to reducing carbon intensity per transport work by at least 40% by 2030, pursuing efforts towards 70% by 2050, and total annual GHG emissions from international shipping by at least 50% by 2050 compared to 2008 and work towards phasing them out as soon as possible. The 2018 Initial Strategy includes a specific reference to "a pathway of CO_2 emissions reduction consistent with the Paris Agreement temperature goals".

The Initial IMO Strategy represents a framework for Member States, setting out the future vision for international shipping, the levels of ambition to reduce GHG emissions and guiding principles; and includes candidate short-, mid- and long-term measures with possible timelines and an assessment of their impacts on States. A revised IMO GHG Strategy is to be adopted in 2023.

Since the adoption of the Initial Strategy, IMO has been actively working on translating the strategically defined levels of ambition to mandatory requirements that apply to individual ships to ensure that the levels of ambition are effectively achieved in line with the agreed timelines. As such, IMO's commitments do not just remain aspirational targets but lay down a binding regulatory framework that applies to the world fleet and is enforced globally.

IMO regulations apply worldwide, thus providing a global equal level playing field. IMO's regulations do not lead to distortion of specific trade flows and trade agreements, and as such do not lead carbon leakage or to sub-optimal shipping in certain parts of the world.

Since COP25, despite the difficulties imposed by the COVID-19 pandemic and postponements of meetings during the first half of 2020, IMO Member States have worked constructively to ensure that the Organization would remain on track with the implementation of the 2018 Initial IMO GHG Strategy and made the following progression, inter alia:

1. Adoption of amendments to MARPOL Annex VI to bring forward to 2022 instead of 2025 the energy efficiency mandatory requirements for several ship types with up to 50 percent carbon intensity reduction for largest containerships;
2. Approval of The Fourth IMO GHG Study by the IMO Marine Environment Protection Committee in November 2020 (MEPC 75). The study reveals that GHG emissions from shipping (international, domestic and fishing) have increased from 977 million tonnes in 2012 to 1,076 million tonnes in 2018 (9.6% increase) bringing the share of shipping emissions in global anthropogenic emissions from 2.76% to 2.89%. However, the study finds that carbon intensity has improved by about 30% between 2008 and 2018 for international shipping as a whole, as well as for most ship types. The study also forecasts an increase to 90-130% of 2008 emissions by 2050.
3. Adoption of short-term measure at MEPC 76 in June 2021 consisting of a combined technical and operational approach to improve the energy efficiency of ships in line with the ambition of the Initial IMO GHG Strategy, which aims to reduce carbon intensity of international shipping by 40% by 2030, compared to 2008, while also providing important building blocks for future GHG reduction measures to reach the level of ambition of the Initial IMO Strategy.
4. Adoption of a resolution on NAPs, resolution MEPC.327(75), urging Member States to develop and update a voluntary NAP with a view to contributing to reducing GHG emissions from international shipping by supporting actions at national level, such as cooperation between the ports and shipping industry as well as along the maritime value chain.
5. Assessment of impact on States - According to the Initial Strategy, the adoption of emissions reduction measures should be supported by an evidence-based impact assessment taking into account, as appropriate, analysis tools and models. MEPC 74 approved a Procedure for assessing impacts on States of candidate measures; The terms of reference for comprehensively assessing the possible impacts of the short-term measure on States were agreed at MEPC 75. In line with the Initial Strategy, they provide for particular attention to be paid to the needs of developing countries, in particular SIDS and least developed countries

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(LDCs). In June 2021, IMO agreed to keep under review the impacts on States of the amendments to MARPOL Annex VI under the short-term measure so that any necessary adjustments can be made, and initiated a lessons-learned exercise of the comprehensive impact assessment.

6. Progressing work on Alternative Fuels. Technological innovation and the global introduction of alternative fuels and/or energy sources for international shipping will be integral to achieve the ambition set out in the Initial IMO Strategy on reduction of GHG emissions from ships. The 2021 IMO Symposium on alternative low-carbon and zero-carbon fuels for shipping presented state-of-the art research and innovation, discussed the advancement of alternative low-carbon and zero-carbon fuels in international shipping, and looked at initiatives to promote the availability, affordability and uptake of future marine fuels.
7. Life-cycle GHG assessment of marine fuels is a prerequisite for the uptake of alternative fuels. MEPC 76 instructed the Intersessional Working Group on Reduction of GHG Emissions from Ships (ISWG-GHG) 9, taking place from 15-17 September 2021 to further consider concrete proposals to encourage the uptake of alternative low-carbon and zero-carbon fuels, including the development of lifecycle GHG/carbon intensity guidelines for all relevant types of fuels.
8. Initial consideration of mid- and long-term measures - MEPC 76 approved a Work plan for development of mid- and long-term measures aiming at supporting the achievement of the vision and the levels of ambition agreed in the Initial Strategy. The Committee requested ISWG-GHG 10 (October 2021) to use the work plan as a basis and as guidance for its further work on the consideration of concrete measures proposals.

The work plan consists of three main phases:

- Phase I – Collation and initial consideration of proposals for measures;
- Phase II – Assessment and selection of measure(s) to further develop; and
- Phase III – Development of (a) measure(s) to be finalized within (an) agreed target date(s).

4.3 Developing ocean-based renewable energy

Ocean renewable energy includes wave energy, tidal energy, salinity gradient energy, and ocean thermal energy conversion. According to the International Renewable Energy Agency (IRENA),[86] 525.8 megawatts of ocean renewable energy was installed worldwide in 2020, a slight increase from 524.7 megawatts in 2019 and 502.7 megawatts in 2011. In addition, offshore wind is considered ocean-based renewable energy, and is growing more rapidly than ocean renewable energy. Stronger winds are available offshore than in comparison to winds used to generate onshore wind energy. Offshore

86 IRENA website at https://www.irena.org/ocean

floating photovoltaic (PV) is also an emerging ocean-based technology.

As of 2020, the capacity of offshore wind energy worldwide reached approximately 34.4 gigawatts. More than 70% of offshore wind capacity is in Europe, either in the North Sea or in the Atlantic Ocean. Over the past two decades, Belgium, Denmark, China, Germany and the UK have led the offshore energy deployment in the global market. Globally, 31 countries are pursuing ocean energy projects other than offshore wind. At the forefront are European countries such as Finland, France, Ireland, Italy, Portugal, Spain, Sweden and the UK, in addition to Australia, Canada and the USA. However, these technologies have various degrees of maturity.[87]

While offshore wind power is a relatively mature technology and already commercialized, other ocean-based renewables are emerging technologies with varying degrees of maturity. Most are still in the research, development and demonstration (RD&D) phases. Tidal energy technologies represent the majority of the global installed ocean energy capacity with around 512 MW, of which 501.5 MW is operational tidal barge plants. Most wave energy deployments are restricted to demonstration and pilot projects. Both wave and tidal energy technologies are gaining momentum, however, with devices increasing in size and power ratings. Ocean Thermal Energy Conversion (OTEC) is still in the R&D phase with current implementation limited to 100 kW demonstration plants in Hawaii (USA) and Japan. Salinity gradient is the least mature ocean energy technology, and globally only one project with a capacity of 50 kW was operational in 2020, in the Netherlands.[88]

There is increasing deployment of floating solar photovoltaic (PV) technology in saltwater. To accommodate the specific needs of islands and lands with limited water surfaces, R&D is being done near seawater shores. Floating solar technology at sea performs, on average, 13% more efficiently (in kWh/m² installed) than solar PV on land, due mainly to lower temperatures and less cloud cover. While most seawater floating solar projects are currently in RD&D stages, several commercial projects are expected to become operational in the next few years. For example, the Seychelles is planning to install a 5.8 MW FPV array on a lagoon on its main island. Singapore is also pursuing deployment of FPV as part of its target to maximise the deployment of solar panels.

Offshore wind, floating solar PV and nascent ocean technologies hold promise for SIDS, helping them to address the acute energy and water supply challenges, and helping build blue economies. However, because these technologies are immature, they are bound to face a series of challenges that could encumber the commercialisation that would realise their full potential.

Offshore renewables will be located mostly in harsh environmental conditions, and in areas with almost non-existent power grids. This corresponds to high capital costs and electricity prices. The limited established supply chains and low cost-competitiveness with other mature renewable energy sources, in addition to the lack of regulatory frameworks and inclusion in national policies, creates a gap to commercialisation. Such barriers have adverse effects on social awareness of offshore renewables, which shapes both the public and investors' trust in these technologies.[89]

Despite these challenges, IRENA foresees a massive growth in offshore wind, ocean energy and floating photovoltaic in the coming decades to put the world on a pathway towards the 1.5°C scenario. For example, offshore wind could increase from 34 GW in 2020 to reach 380 GW by 2030 and more than 2,000 GW by 2050. Ocean energy would represent additional 350 GW of offshore renewable generation capacity by 2050.[90]

Offshore renewables also have the potential to contribute to the SDG 14 on the conservation and sustainable use of oceans, coupling energy with blue economy activities like fishery, shipping, and tourism. A blue economy fuelled by offshore renewables would help islands and countries with coastal areas to meet their national goals aligned with the Paris Agreement, their NDCs and the Sustainable Development Agenda for 2030.

The Ocean Renewable Energy Action Coalition[91] was launched in 2020 to accelerate global offshore wind capacity. Bringing together civil society, intergovernmental institutions and industry, the Action Coalition represents the offshore wind sector in the global dialogue on climate action. It is spearheaded by Ørsted and Equinor and also includes: CWind, Global Marine Group, JERA, MHI Vestas, Mainstream Renewable Power, Shell, Siemens Gamesa, TenneT and The Crown Estate. The Action Coalition was formed in response to the September 2019 Call for Ocean-Based Climate Action made by the High-Level Panel for a Sustainable Ocean Economy, with additional partners including Global Wind Energy Council and the UN Global Compact. The Action Coalition will prepare a vision for 2050, highlighting

87 IRENA (2021), Offshore renewables: An action agenda for deployment, International Renewable Energy Agency, Abu Dhabi.
88 IRENA (2021), Offshore renewables: An action agenda for deployment, International Renewable Energy Agency, Abu Dhabi

89 IRENA (2021), Offshore renewables: An action agenda for deployment, International Renewable Energy Agency, Abu Dhabi.
90 IRENA (2021), Offshore renewables: An action agenda for deployment, International Renewable Energy Agency, Abu Dhabi.
91 https://gwec.net/oreac/

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the actions that industry, financiers and governments can take to sustainably scale-up offshore wind, and thereby contribute to the UN Sustainable Development Goals and global decarbonization goals.

Substantial progress on renewable ocean energy has been made in Europe. To help meet the EU's goal of climate neutrality by 2050, the European Commission presented in 2020 the EU Strategy on Offshore Renewable Energy. The Strategy proposes to increase Europe's offshore wind capacity from its current level of 12 GW to at least 60 GW by 2030 and to 300 GW by 2050. The Commission aims to complement this with 40 GW of ocean energy and other emerging technologies such as floating wind and solar by 2050.

In July 2021, the European Commission adopted a package of proposals ("Fit for 55") to make the EU's climate, energy, land use, transport and taxation policies fit for reducing net greenhouse gas emissions by at least 55% by 2030, compared to 1990 levels. This package recognises the importance of protecting nature and increasing the EU's natural carbon sink.

The EU approach demonstrates that the twin climate and biodiversity crises cannot be treated separately. We either solve the climate and nature crises together, or we solve neither. This also means that we should not take more resources than the planet can afford to share with us. If we help delicate land and ocean ecosystems recover, they can provide for life on the planet and fulfil their role in the fight against climate change. Restoring nature and enabling biodiversity to thrive again is essential to absorb and store more carbon. The EU is therefore seeking to increase the capacity of the EU's forests, soils, wetlands and peatlands, oceans, and water bodies to act as carbon sinks and stocks

4.4 Considering ocean-based carbon capture and storage

Carbon capture and storage (CCS) is a technology that aims for the permanent isolation and storage underground (sequestration) of CO_2. The largest potential to store CO_2 (once captured and compressed) is in the ocean in sub-seabed geological formations, substantially reducing adverse environmental impacts relative to those that occur as a result of atmospheric release of CO_2. Depleted oil and gas fields, for example, can provide suitable storage potential for CO_2. The technique is appropriate for large single-point CO_2 emission sources such as power stations and chemical and cement plants.

The world's first large-scale dedicated CO_2 storage operation started at the Sleipner gas field in the Norwegian North Sea in 1996. This pioneering project captured the CO_2 on the Sleipner gas platform and piped it back down beneath the seabed, to be stored in a deep saline reservoir. Since starting injection in 1996, several other industrial-scale CCS projects have emerged (in Norway, Canada, USA, Australia and elsewhere). Recent reviews have shown that no CCS barriers are exclusively technical, with cost being the most significant hurdle in the short to medium term, whereas in the long term, CCS is found to be very cost effective when compared with other mitigation options.[92]

In 2005, following concerns raised about the potential marine environmental impacts of CCS, Contracting Parties to the London Convention (1972) and its 1996 Protocol (London Protocol),[93] the global agreements regulating dumping of wastes at sea, acknowledged that CO_2 sequestration had a role to play, as part of a suite of measures to tackle the challenge of climate change and ocean acidification, and agreed that the treaties were appropriate global instruments to address the implications of CO_2 sequestration for the marine environment. Potential risks include those associated with leakage into the marine environment of CO_2 and other substances in, or mobilized by, the CO_2 stream. Subsequently in 2007, the London Protocol Parties took decisive action to enable CO_2 storage in the sub-sea bed when it is safe to do so, providing a basis in international environmental law to regulate the injection of CO_2 waste streams into sub-seabed geological formations for permanent isolation.[94] Contracting Parties to the London Convention and Protocol also developed guidance to address the risks posed by CCS in sub-seabed geological formations and potential effects on the marine environment.[95]

In 2009, the Parties amended Article 6 of the London Protocol concerning the export of wastes for dumping purposes, aimed at enabling Parties to share transboundary sub-seabed geological formations for sequestration projects, on the condition that the marine environmental protection standards of the Protocol are fully met. However, the 2009 export amendment is not yet in force as it needs to be ratified by being formally accepted by two-thirds of the Parties to the Protocol and will then come into force globally 60 days later. As a result, in 2019, the London Protocol Parties approved a Resolution for Provisional Application of the 2009 export amendment. This removes the legal and regulatory barriers and allows countries to agree to export and receive CO_2 for offshore geological storage.

In 2020, the Norwegian Government announced a full-scale carbon capture and storage project called Longship, which will be the first ever cross-border, open-source CO_2 transport and storage infrastructure network and offers companies across Europe the opportunity to store their CO_2 permanently underground. Phase one of the project will be completed in mid-2024 with a capacity of up to 1.5 million tonnes of CO_2 per year. Longship includes capturing CO_2 from industrial sources and shipping liquid CO_2 from these industrial capture sites to an onshore terminal on the Norwegian west coast, the CO_2 storage part of the overall demonstration project is called Northern Lights.[96] From there, the liquefied CO_2 will be transported by pipeline to an offshore storage location subsea in the North Sea, for permanent storage.

4.5 Summary of achievements and future needs on ocean-related mitigation

There has been considerable progress made on mitigation since the start of the ROCA initiative. This section of the report describes examples of such progress. Nature-based solutions, such as blue carbon, are becoming mainstream, and an increasing number of countries are committing to advancing ocean-climate solutions in their NDCs. Progress is being made towards reducing CO_2 emissions from maritime transport, and in renewable energy technologies. Encouragingly, new and experimental ocean-based renewable energy technologies are in research, development, and demonstration and the demand for them will likely grow in the future. Ocean-based carbon capture and storage is also seeing increasing viability with the Norwegian Longship project.

There is still a need for further concrete actions in all of these aspects of mitigation, including further development of technologies and funding for countries to adopt and apply them. In particular, there is a need for SIDS and coastal developing countries to be able to benefit from ocean-based renewable energy, including offshore wind, floating solar PV and nascent ocean technologies, and further advancement in technologies and micro-grids will be required to advance these solutions.

92 Budinisa, S., Krevorc, S., Mac Dowell, N., Brandon, N. & Hawkes, A. (2018) An assessment of CCS costs, barriers and potential. Energy Strategy Reviews 22, 61-68.
93 https://www.imo.org/en/OurWork/Environment/Pages/London-Convention-Protocol.aspx
94 https://www.imo.org/en/OurWork/Environment/Pages/CCS-Default.aspx
95 https://wwwcdn.imo.org/localresources/en/OurWork/Environment/Documents/2012%20SPECIFIC%20GUIDELINES%20FOR%20THE%20ASSESSMENT%20OF%20CARBON%20DIOXIDE.pdf
96 https://northernlightsccs.com/

5. ADAPTATION

Section 5 focuses on adaptation measures, based on the following Roadmap recommendations: *Implement ecosystem-based adaptation (EbA) strategies through integrated coastal and ocean management institutions at national, regional, and local levels to reduce vulnerability of coastal/ocean ecosystems and of human settlements, and to build the management capacity, preparedness, resilience, and adaptive capacities of coastal and island communities.* Section 5.1 discusses adaptation actions within and outside of UNFCCC, including how ocean and coastal ecosystems are addressed in NAPs and NDCs, and the use of tools such as coastal management, marine protected areas (MPAs) and marine spatial planning (MSP). Section 5.2 discusses fisheries and fishery-related adaptation options, as well as guidance.

5.1 Actions within and outside of UNFCCC

One of the major impacts of climate change is that global sea-level rise and increased storms are impacting coastlines, coastal ecosystems and coastal populations and communities in very significant ways. This combination of accelerating sea-level rise and intensified storminess due to climate and ocean warming is increasing the exposure of the world's coastlines to hazardous events and causing major changes in ocean chemistry and ecosystems. While the degree of exposure varies significantly depending upon geographic location, the climatic and severe weather events that create hazardous events are intensifying and occurring with increasing frequency.

Since the first ROCA progress report in 2017, these impacts have increased in frequency and intensity around the world to such a degree that almost every coastal zone is being forced to make significant adaptations to protect critical infrastructure, human occupation and livelihoods. The cumulative impacts of climate change on coastal and ocean environments are now being felt so quickly that short-term adaptations are becoming ineffective in responding to the threats and challenges being faced by coastal and ocean communities. Extreme events, such as hurricanes, and tropical storms, have become especially catastrophic, but the cumulative impacts of increased storminess and precipitation, such as from more frequent mid-latitude cyclones and intensified monsoon seasons, are no longer creating slow and subtle impacts on human activities in the world's coastal zones, but are resulting in significant and immediate impacts. These impacts include flooding of low-lying coastal areas; erosion of beaches, dunes, bluffs and cliffs; degradation of salt marshes, coastal flats, estuaries, and mangroves; and loss of productive coastal ecosystems; as

Figure 3. Storms crash along the coast.

well as direct physical damage by storm surges, waves, wind, and water inundation due to increased precipitation and rising sea levels. In the Arctic, such impacts are further intensified by reductions in sea ice causing more open wave and current action along coastal zones, as well as permafrost melt causing sub-aerial cliff erosion (slumping and other forms of slope erosion) and coastal land subsidence. Climate change is having a huge impact on coastal communities that depend upon resources that are responding to changing physical conditions. Fishing communities are having to adapt to significant shifts in primary and secondary productivity in oceans and coastal waters around the world.

The parties to the UNFCCC and the Paris Agreement recognize that adaptation is a global challenge faced by all with local, subnational, national, regional and international dimensions. It is a key component of the long-term global response to climate change to protect people, livelihoods and ecosystems. Parties acknowledge that adaptation action should follow a country-driven, gender-responsive, participatory and fully transparent approach, considering vulnerable groups, communities and ecosystems, and should be based on and guided by the best available science and, as appropriate, traditional knowledge, knowledge of indigenous peoples and local knowledge systems, with a view to integrating adaptation into relevant socioeconomic and environmental policies and actions.

Increased ambition for ocean-based adaptation is evident in the updated NDCs. Of the 30 countries that have incorporated coastal and marine NbS in their updated NDCs, three types of solutions for adaptation are prevalent:

1) protecting and restoring coastal and marine ecosystems; 2) coastal zone management and MPAs; and 3) climate-ready fisheries and aquaculture. 13 countries included all three solution types in their updated NDCs.[97]

97 Lecerf, M., Herr D., Thomas, T., Elverum, C., Delrieu, E. and Picourt, L., (2021), Coastal and marine ecosystems as Nature-based Solutions in new or updated Nationally Determined Contributions, Ocean & Climate Platform, Conservation International, IUCN, GIZ, Rare, The Nature Conservancy and WWF.

Photograph: OceanImageBank_Kimberly Jeffries

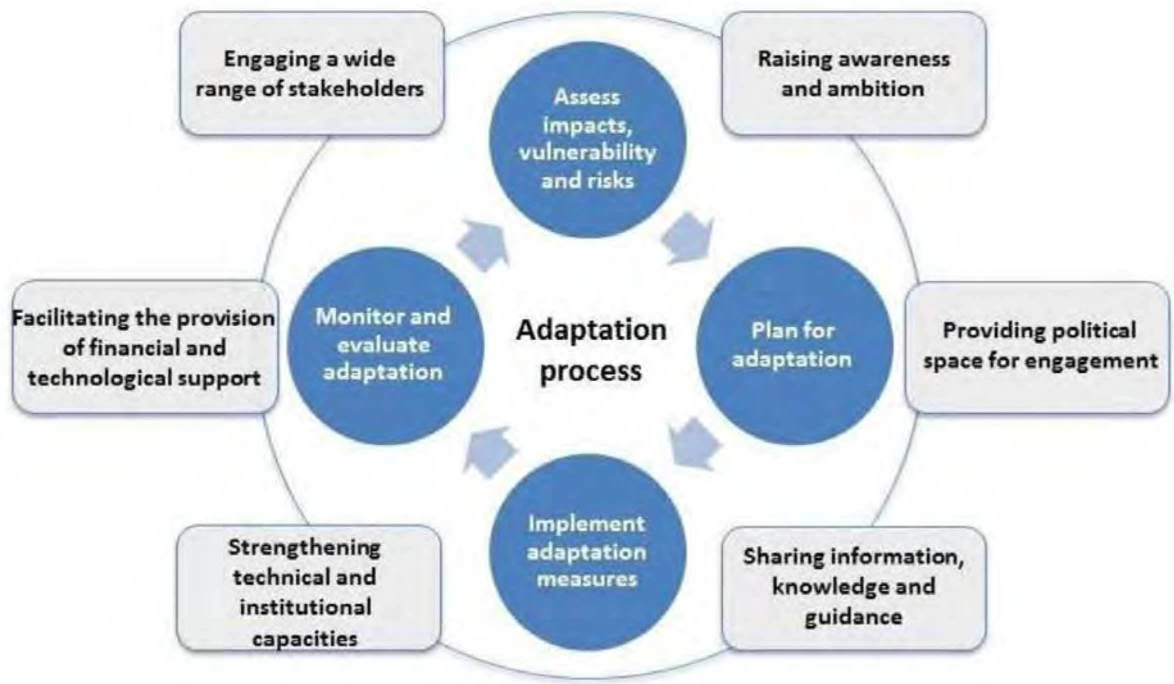

Figure 4: Adaptation Cycle under the UN Climate Change Regime[98]

The adaptation cycle under the UN climate change regime includes four general components, which are presented in the figure below. Within the UN climate change regime, adaptation-related activities are carried out in a number of workstreams, through work programmes and in specialized groups and committees, including National Adaptation Programmes of Action (NAPAs). National Adaptation Plans (NAPs), the Least Developed Countries Expert Group (LEG), and the Adaptation Committee. Within the Paris Agreement, the Global Goal on Adaptation sets out to enhance adaptive capacity and strengthen resilience, with a view to reducing vulnerability and contributing to sustainable development. It requires all parties to engage in and communicate their efforts to plan and implement adaptation.

The 2021 Report of the Adaptation Committee[99] included recommendations for the COP26 to:

- strongly encourage Parties to prepare and submit NAPs, reports and communications regularly and in a timely manner;
- strongly encourage Parties to develop and implement national monitoring, evaluation and learning; and
- urge developed countries in particular, as well as United Nations organizations, specialized, bilateral and multilateral agencies and other relevant organizations, to continue to mobilize technical and financial support for adaptation activities in developing countries with a view to making progress towards the global goal on adaptation.

In the context of oceans and coasts, adaptation involves planning and defining strategies to protect marine, coastal and human systems from climate change impacts, and determining ways we can adapt to the new climate norms that are being established as we move beyond 1.5ºC of global warming. Projected changes, impacts and risks for ocean regions and ecosystems vary considerably, and adaptation measures are being developed accordingly. In many cases, using the inherent capabilities of natural ecosystems can be the best form of adaptation, and identifying those ecosystems which are most at risk from climate change is very important. Increased frequency and intensity of marine weather events, together with temperature and chemical changes in ocean waters are impacting local coastal communities, species habitats, ocean productivity, and ecosystem services for the worse, and those impacts are continuing to intensify as global warming rises. Not all ecosystems and species will be equally resilient to these changes and the ability to adapt will vary between different ecosystems and species as well.

The clear message from the 1.5ºC and the Special Report on the Ocean and Cryosphere in a Changing Climate (SROCC) reports is that current rates of climate change impacts are far exceeding the capacities of tradition forms of adaptation, and that new, innovative approaches are required to address the impending impacts and create coastal communities that are more resilient

98 https://unfccc.int/topics/adaptation-and-resilience/the-big-picture/what-do-adaptation-to-climate-change-and-climate-resilience-mean
99 https://unfccc.int/sites/default/files/resource/sb2021_06_adv.pdf

in surviving the new climate regime into which the world has moved. This new reality has been further reinforced by the most recent IPCC report "Climate Change 2021: The Physical Science Basis,"[100] which is the first of the working group reports to come out of the 6th Assessment process in August 2021. This new report concludes that: 1) it is unequivocal that human influence has warmed the atmosphere, ocean and land, and that widespread and rapid changes in the atmosphere, ocean, cryosphere and biosphere have occurred; 2) the scale of recent changes across the climate system as a whole and the present state of many aspects of the climate system are unprecedented over many centuries to many thousands of years; and 3) human-induced climate change is already affecting many weather and climate extremes in every region across the globe, with evidence of observed changes in extremes such as heatwaves, heavy precipitation, droughts, and tropical cyclones, and, in particular, their attribution to human influence, strengthening since the Fifth Assessment Report in 2014.

The impact of increasing global warming and extreme weather events are resulting in changes to both the distribution and abundance of fish populations. This is having significant impacts on coastal communities, especially Indigenous communities that have relied on the ocean for sustaining themselves for generations.[101] This highlights how the impacts on oceans, as well as the associated costs, are not evenly distributed but rather are impacting already marginalized communities, including Indigenous communities, poorer local communities, and the over 60 million people living in SIDS opional and other low-lying areas, more immediately and with more devastating effects. These communities' historical contribution to global greenhouse gas emissions is less than 1 percent,[102] yet they will face the full force of climate changes resulting from those emissions and often possess the least resources and capabilities to adapt effectively to such rapid, large-scale changes.

Scientists have been warning of the catastrophic impacts that climate change is having upon the world's oceans[103] [104] [105] and that these impacts are cumulative over time and will continue to increase in severity.

Over the years since the ROCA was initiated, the world has experienced the most devastating hurricanes and typhoons that have highlighted the enormous effects that climate change is having on the world's coasts and the subsequent impacts upon the global population. Successive years of above normal activity and record storm events have occurred starting in 2016 with four consecutive seasons to feature at least one Category 5 hurricane, namely Matthew in 2016; Irma and Maria in 2017, Michael in 2018, and Dorian in 2019. Although 2020 did not feature a Category 5 storm, it was the most active hurricane season on record and as named storm went through the entire alphabet, the Greek alphabet was used for only the second time since 2005.

The 2019 hurricane season saw the second strongest Atlantic hurricane on record, Dorian, which left parts of the Bahamas in ruins and caused significant damage along the eastern coast of the United States and Canada. Grand Bahamas had been hit with another category five hurricane as recently as 2017, and many Bahamians had yet to fully restore their houses when Dorian hit.[106] However, the Atlantic is far from the only ocean that has witnessed some significant storms during 2019. Just weeks before Dorian, China was hit with the deadly typhoon Lekima which according to Chinese officials affected 5 million people and forced 1 million people to be relocated from their homes.[107] Lekima, which was the ninth typhoon to hit China in 2019, damaged up to 34,000 houses and caused expected economic damage of 14.57 billion yuan (or US$2.7 billion).[108] Furthermore, in March Australia was hit with two category four cyclones at the same time, a phenomenon that has only occurred twice in the country's history.[109] In May 2019, cyclone Fani hit Bangladesh and India displacing over 3 million people,[110] but thanks to effective government organization and communication only 40 people lost their lives when Fani hit India, which was only a fraction of the people at risk.[111] According to the Global Climate Index 2019, this trend of increasing extreme weather events has been observed across the world and will only continue to intensify in the next decades.[112] More than half

100 IPCC, Climate Change 2021: The Physical Science Basis, Report of Working Group I, 6th Assessment Report, August 2021 (https://www.ipcc.ch/report/sixth-assessment-report-working-group-i/)
101 IPCC, SROCC, 2019.
102 Ibid.
103 Schubert, R, H.-J. Schellnhuber, N. Buchmann, A. Epiney, R. Griessham- mer, M. Kulsella, D. Messner, S. Rahmstorf, and J. Schmid. (2006). The Future Oceans: Warming Up, Rising High, Turning Sour. Special report, German Advisory Council on Global Change (WBGU), Berlin, 110p
104 Ricketts, P.J. (2009). "State of Fear or State of Oblivion? What Coastal Zones are Telling us about Global Change and Why We Need Integrated Ocean and Coastal Management on a Global Scale", in Moksness, E, E. Dahl, and J. StÆttrup (Eds.), Integrated Coastal Zone Management, Chapter 1, Black- well Publishing, pp. 1-23.
105 IPCC. (2014). Climate Change 2014: Synthesis Report. Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, R.K. Pachauri and L.A. Meyer (eds.)]. IPCC, Geneva, Switzerland, 151 p.
106 BBC, "Hurricane Dorian: Path of destruction," (September 9, 2019), available online: <https://www.bbc.com/news/world-latin-america-49553770>.
107 J. Hollingsworth, S. Wang and T. Ward, "1 million evacuated as Typhoon Lekima makes landfall," (August 10, 2019), available online: <https://www.cnn.com/2019/08/09/asia/typhoon-lekima-china-taiwan-intl-hnk/index.html>.
108 BBC, "Typhoon Lekima: Toll rises as typhoon moves up China coast," (August 11, 2019), available online: <https://www.bbc.com/news/world-asia-china-49310258>.
109 BBC, "Cyclone Veronica: Destructive winds and rain lash Australia," (March 25, 2019), available online: <https://www.bbc.com/news/world-australia-47688551>.
110 Internal Displacement Monitoring Centre, n. 102 above.
111 A. Prakash and N. Dolšak, "Analysis: Why did India's devastating Cyclone Fani kill only 40 people, not 10,000? Thank democracy and technology," (May 18, 2019), available online: <https://www.washingtonpost.com/politics/2019/05/17/why-did-indias-devastating-cyclone-fani-kill-only-people-not-thank-democracy-technology/>.
112 D. Eckstein, M.-L. Hutfils and M. Winges, *Global Climate Risk Index 2019: Who Suffers Most from Extreme Weather Events? Weather-related Loss Events in 2017 and 1998 to 2017* (Bonn: Germanwatch, 2018).

a million people lost their lives between 1998 and 2017 due to the direct result of over 11,000 extreme weather events, with low-income countries being among the worst affected.[113] Climate scientists have clearly identified a relationship between extreme weather events (like cyclones, hurricanes, and typhoons) and climate change, and it is expected that with every one-tenth of a degree increase in global temperature the number of extreme tropical cyclones will increase.[114]

At the time of writing, the 2021 hurricane season has produced 19 named storms and had one of the earliest starts (May 22) on record. Hurricane Ida was a deadly and destructive hurricane that made landfall in the U.S. state of Louisiana at Category 4 strength, becoming the most intense and destructive tropical cyclone to affect the state since Hurricane Katrina. It had previously caused death and destruction in Venezuela and Cuba, that then went on to cause extensive flash flooding across the northeastern USA. Ida caused at least $50.1 billion (2021 USD) in damages, including at least $50 billion in the US and $100 million in Cuba, and at least 86 direct and 23 indirect fatalities in the United States. Hurricane Larry peaked as a powerful Category 3 hurricane over the open Atlantic before striking the Canadian province of Newfoundland and Labrador as a Category 1.

Since 2016, the ROCA reports present a disturbing picture of the level of environmental deterioration in the global oceans due to climate change impacts and the increasing demands and pressures for ever more innovative modes of adaptation. There is no doubt that around the world we are seeing real and tangible impacts of climate change on a scale that has not been experienced before. These impacts are causing increasing loss of life and livelihood, as well as inflicting billions of dollars of damage to buildings, harbours, and infrastructure in coastal zones, and rendering large areas of populated coastal regions potentially uninhabitable.

Coastal property and infrastructure are increasingly at risk from sea level rise and storm events. Due to the real and potential impacts on coastal ecosystems, economies, and the human use of these areas, predicting areas that will be most affected by increased severe and extreme events must be an important component of adjustment and mitigation activities in response to climate change. Adapting to changes in oceans and coastal areas requires developing appropriate strategies and plans to protect both ecosystems and communities as temperatures continue to increase. With increasing threats from sea level rise and storm events, coastal infrastructures and properties are at increased risk. Impacts of climate change will further impact nations both socially, environmentally, and economically. To predict these impacts, several countries have started to map their coasts including Canada,[115] India, [116] and the United States.[117] The hope is that these efforts will help with both national, regional, and local adaptation efforts. Coastal cities around the world are increasingly threatened by rising sea levels. In the United States alone 13 million people risk being displaced. In Canada, entire provinces, like Prince Edward Island and Nova Scotia, are facing significant impacts[118] and similar situations are seen around the world with the most vulnerable communities being the most affected. During the first half of 2019, almost 1.7 million people in Bangladesh were displaced due to natural disasters with most of them being part of socially and economically vulnerable groups.[119] The socioeconomic dimensions of displacement will become increasingly important in the next decades as predictions suggest that by 2100, sea level rise will displace up to 187 million people globally.[120]

Mapping coastal areas is an important part of developing adaptation strategies and policies in order to prepare for increasing extreme weather events and higher sea levels. In Atlantic Canada, for example, the predicted impacts of sea-level rise, storm surges, and extreme weather events on coastal areas has been mapped since the late 1990s, in order to identify which parts of the coastline will require the greatest efforts in terms of adaptation and mitigation. Prince Edward Island is facing a significant loss of land due to sea level rise, increased coastal erosion and flooding, and assessment done by the UPEI Climate Lab has mapped erosion rates around the island province and compiled simulation models of predicted erosion based on historical rates. In recent years, erosion rates of up to 1.43 meters per year have been recorded and the information is made available to the public and especially coastal landowners and communities.[121] Adaptation measures have been re-designed to deal with long-term erosion acceleration but today the immediate impacts of climate change are

113 Ibid.
114 Ibid.

115 Climate Impacts and Adaptation Science (CIAS), 2011, available online: <http://projects.upei.ca/climate/publications/climate-impacts-and-adaptation-science-cias/>.
116 R. Ramesh et al., "Hazard line for the coast of India and its implications in coastal management," in *Climate Change and the Vulnerable Indian Coast* R. Ramesh and J.R. Bhatt eds., (New Delhi: Ministry of Environment, Forest and Climate Change, 2018), pp. 11–49.
117 NOAA. (n.d.). About Digital Coast, available online: <https://coast.noaa.gov/digitalcoast/about/>.
118 Ibid.
119 Internal Displacement Monitoring Centre, *Mid-Year Figures, Internal Displacement from January to June 2019* (2019), pp. 1–16.
120 J.L. Bamber et al., "Ice sheet contributions to future sea-level rise from structured expert judgment," *Proceedings of the National Academy of Sciences* 116, no. 23 (2019): 11195–11200.
121 CBC, "We're the most vulnerable: Measuring P.E.I.'s erosion from land and sky," (June 17, 2020), available online: <https://www.cbc.ca/news/canada/prince-edward-island/pei-coastal-erosion-drones-1.5171990>.

so severe that it is no longer a matter of adapting to predicted erosion, but actual erosion as it is occurring Other countries, like the United States and Australia are also mapping the impact of increasing sea level rise and making the information publicly accessible and available through digital programs.[122] Furthermore, researchers in the United States have mapped out how internet infrastructure will be impacted by rising sea levels, claiming that thousands of miles of fiber optic cable, as well as other important infrastructure in the country could be under water within the next 15 years.[123] While some of the infrastructure might be able to withstand a certain amount of water, little of it was designed to be completely submerged. This would have significant impacts on the American way of life as much of the U.S. society is reliant on internet access for every day services including for accessing electronic medical files, controlling the color of street lights, and other important everyday functions.[124] Many coastal States in the U.S. have mapped and developed erosion zones under their State coastal zone management programs, and federal agencies such as the Federal Emergency Management Agency (FEMA) have developed surge and flooding models for high risk coastal areas. Under a recent national coastal management initiative, India has used aerial photographs to map a hazard-line along its coast to determine how vulnerable different regions are to natural hazards like storm-surges, cyclones, erosion, and tsunamis.[125] In Sweden, work is also underway to map both the effects of sea level rise[126] and coastal erosion[127] with the hope that it will increase the awareness about these issues as well as make communities better equipped to deal with them. Even Google Earth allows its users to explore the impact that sea level rise could have on coastal cities.

The countries that are most immediately affected by increasing sea levels are low-lying SIDS that are facing displacement and, in some cases, complete submergence. To make matters worse, it is predicted that sea level rise is four times the global average for the world's 52 SIDS, resulting in damaged ecosystems and trillions of dollars in economic losses. It is now predicted that relocation due to climate change may become common in the Pacific region as early as the 2040s and the list of SIDS that may be completely submerged by the end of the century is reason for alarm.[128] However, SIDS will not only be affected by climate change in terms of rising sea levels, but also through coral bleaching, loss of biodiversity, more extreme weather events, food insecurity, lack of access to freshwater, and economic despair as well.[129] As Barnett states "climate change puts at risk the very basic and universal need for people in Pacific SIDS to have access to sufficient, safe and nutritious food at all times,"[130] further stressing the importance for holistic and multifaceted adaptation efforts.

However, climate change would also impose other risks on SIDS including loss of ecosystems and adaptive capacities which the inhabitants of these islands depend on to sustain themselves.[131] Furthermore, many of these islands do not have an abundance of resources, making them even more vulnerable and less able to adapt to potential losses. Complicating the question further, many island States rely on tourism as one of their main sectors in their economy; however, losing parts of their environment could significantly impact this since a large proportion of the tourists visiting come for the natural beauty of these islands.[132]

These increased hazards resulting from climate change will be challenging for large and small coastal communities alike, emphasizing the need for governments at all levels, national, regional, and local, to develop clear policies for coastal protection, planning, and damage response. Increasing the resilience of coastal communities and providing for effective adaptation to damage and loss will be critical aspects of managing the world's coastlines as climate change continues to increase exposure to hazard and risk.

With the impending pressures of climate change, investing in adaptation may be a nation's best strategy. According to the Global Commission for Adaptation, investing in adaptation could generate benefits four times as great as the investment.[133] These include investing in strengthening early warning systems, making new infrastructure resilient, improving dryland agriculture crop production, protecting mangroves, and making water resources management more resilient. Nations are also developing more and stronger policies focusing on adaptation. One example on Canada's east coast is the Province of Nova Scotia which introduced a Coastal

122 NOAA, CoastAdapt. (n.d.). About CoastAdapt, available online: <https://coastadapt.com.au/about-coastadapt>.

123 R. Durairajan, C. Barford and P. Barford, "Lights out: Climate change risk to internet infrastructure," in *Proceedings of the Applied Networking Research Workshop 2018*, Montreal, Canada, July 16, 2018, pp. 9–15. doi:10.1145/3232755.3232775.

124 Ibid.

125 Ramesh et al., op. cit.

126 Sveriges Geologiska Undersökning, Kartläggning av Hallands stränder, (September 4, 2018), available online: <https://www.sgu.se/om-sgu/nyheter/2018/september/kartlaggning-av-hallands-strander/>.

127 Sveriges Geologiska Undersökning, Kartläggning av stranderosion i Halland, (March 19, 2019), available online: <https://www.sgu.se/om-sgu/nyheter/2019/mars/kartlaggning-av-stranderosionen-i-halland/>.

128 Ibid.

129 C.D. Storlazzi et al., "Most atolls will be uninhabitable by the mid-21st century because of sea-level rise exacerbating wave-driven flooding," *Science Advances* 4, no. 4 (2018): eaap9741.

130 J. Barnett, "Climate change and food security in the Pacific Islands," in *Food Security in Small Island States* J. Connell and K. Lowitt, eds., (Singapore: Springer, 2019), pp. 25–38.

131 K. Noda et al., "Efficiency and sustainability of land-resource use on a small island," *Environmental Research Letters* 14, no. 5 (2019): 054004.

132 Ibid.

133 Global Commission on Adaptation, *Adapt Now: A Global Call for Leadership on Climate Resilience* (Global Center on Adaptation, Rotterdam, The Netherlands, 2019), 84 p., available online: <https://cdn.gca.org/assets/2019-09/GlobalCommission_Report_FINAL.pdf>.

Protection Act in the spring of 2019 which is aimed at ensuring that nature-based shoreline decision-making is an essential element in managing the development along Nova Scotia's coasts and that new development does not occur in high hazard areas.[134] This builds upon the climate adaptation plans that have been developed by all coastal municipalities in NS and PEI. Scenarios and guidelines for adaptation plans were developed in 2011.[135] There are also opportunities for new economic development based upon climate change adaptation and mitigation, and these may help diversify some resource-based coastal communities that are currently unsustainable.[136]

Gattuso et al.[137] state that while most mitigation and adaptation efforts are land-based, more is needed to identify ocean-based measures as well. The authors undertake an assessment of 13 global- and local-scale, ocean-based measures to help steer the development and implementation of technologies and actions toward a sustainable outcome. Some of them include adaptation measures to help offset degradation to highly vulnerable ocean ecosystems, including coral reefs, ocean vegetation and seagrass beds, and Arctic biota. There is little doubt that increased efforts are going to have to be made both on land and in the ocean in order to be able to adapt effectively to a rapidly deteriorating environment in which coastal hazards and ocean ecosystem degradation will continue to exacerbate as the immediate impacts of climate change continue.

In Canada, many coastal communities, including important population centres like Vancouver and Richmond in British Columbia, Toronto in Ontario, Charlottetown in Prince Edward Island, and Tuktoyaktuk in the Northwest Territories are at considerable risk of serious inundation as a result of climate change impacts, including rising sea levels, increased storm surge penetration, and high lake levels due to changes in precipitation patterns. In some cases, entire provinces are facing significant impacts, including Prince Edward Island where, in addition to its capital city, significant low-lying coastal areas and islands are at risk of being submerged. Nova Scotia faces the very real prospect of becoming an island if the Tantramar marshes become completely inundated by the dynamic tidal waters of the Bay of Fundy. Beyond Canada, the threat to large coastal cities and smaller communities along the eastern seaboard of the United States, especially those on barrier islands and low-lying coastal plains such as in North Carolina, Maryland, Virginia and South Florida, the Gulf of Mexico, and the northwestern coastlines of the United States is also increasing, and the relocation of some communities is being actively considered. It is estimated that 13 million people in the United States alone will be at risk of potential displacement, and communities like Jekyll Island in Georgia, Isle de Jean Charles in Louisiana, and Newtok and Shishmarek in Alaska are all in the process of looking for safer locations for their communities. As the experience of New Orleans during and after Hurricane Katrina clearly demonstrates, poorer communities are especially at risk and a new study by the Center for Progressive Reform emphasizes that many of the most vulnerable at present are Native American communities. This report even provides a guidebook for coastal communities that are looking to relocate. [138]

Vulnerable communities are facing the threat of relocation around the world. In Bangladesh, almost 1.7 million people have already been displaced during the first half of 2019 due to natural disasters, and many of these people belong to low income and other vulnerable societal groups.[139] According to the World Bank´s March 2018 Report, climate change could become the country's number one driver of internal migration by 2050, dis- placing up to 13.3 million people.[140] A similar trend will be seen around the world with recent studies predicting that by 2100, up to 187 million people could be displaced across the globe due to sea level rise.

Another 2017 study by the Union of Concerned Scientists states that in the United States states, "[w]ithin 20 years, by 2035, nearly 170 coastal communities will reach or exceed the threshold for chronic inundation, given moderate sea level rise. Seventy percent of these will be in Louisiana and Maryland, where land subsidence is contributing to rapid rates of sea level rise. More than half of these 170 communities are currently home to socio-economically vulnerable neighborhoods."[141]

Of course, none of this compares to the catastrophic impacts being faced by low-lying SIDS that are facing

134 Nova Scotia *Coastal Protection Act*, available online: <https://novascotia.ca/coast/>._
135 Richards, W and R. Daigle. Scenarios and Guidance for Adaptation to Climate Change and Sea-Level Rise NS and PEI Municipalities, NS Department of Environment, August 2011, 78p.
136 Ricketts, P.J. (2018). Ocean and Climate Change Action: Opportunities for Economic and Environmental Sustainability, in The Future of Ocean Governance and Capacity Development Essays in Honor of Elisabeth Mann Borgese (1918-2002), Ed.: International Ocean Institute Canada, Koninklijke Brill NV, Leiden, 316-325.
137 Gatusso et al. (2018) Ocean solutions to address climate change and its effects on marine ecosystems, Frontiers in Marine Science, 04 October 2018, https://www.frontiersin.org/articles/10.3389/fmars.2018.00337/full.
138 Burkett, Maxine, Robert R.M. Verchick, and David Flores (2017). Reaching Higher Ground: Avenues to Secure and Manage NewLand for Communities Displaced by Climate Change, Center for Progressive Reform, May 2017, Washington DC, 43p.
139 Internal Displacement Monitoring Centre. (2019). *Mid-Year Figures, Internal Displacement from January to June 2019.* (pp. 1–16).
140 Rigaud, Kanta Kumari; de Sherbinin, Alex; Jones, Bryan; Bergmann, Jonas; Clement, Viviane; Ober, Kayly; Schewe, Jacob; Adamo, Susana; McCusker, Brent; Heuser, Silke; Midgley, Amelia. 2018. *Groundswell: Preparing for Internal Climate Migration.* World Bank, Washington, DC. © World Bank. https://open-knowledge.worldbank.org/handle/10986/29461 License: CC BY 3.0 IGO.
141 Spanger-Siegfried, E., K. Dahl, A. Caldas, S. Udvardy, R. Cleetus, P. Worth and N. Hernandez Hammer. (2017). When Rising Seas Hit Home: Hard Choices Ahead for Hundreds of US Coastal Communities, Union of Concerned Scientists, Cambridge, MA, 51p.

the prospect of complete submergence, and in the most extreme cases, the necessity of evacuating their entire population to another country. It is predicted that for the world's 52 SIDS, sea level rise is as much as four times the global average and increasing levels of vulnerability means trillions of dollars in annual economic losses.[142] If present rates of sea level rise continue, the list of islands that will be either entirely or substantially submerged by the end of this century is alarming, and research suggests that relocation due to climate change might become a frequent phenomenon in the Pacific region beginning in the 2040s.[143 144] This includes iconic destinations like the Maldives, the Seychelles, French Polynesia, the Solomon Islands, and New Caledonia. In the Solomon Islands, islands have already started to become uninhabitable and in Kiribati, the majority of the capital city Tarawa is expected to be under water within the coming decades if nothing is done to reduce sea level rise.[145] Kiribati has already taken the precaution of purchasing 6,000 acres of land in Fiji to relocate its population, and Fiji itself is facing catastrophic consequences resulting from climate change, including the loss of vital coral reefs and the potential displacement of large portions of its population. Other low-lying island nations are also preparing for increasing sea level rise and nations like the Marshall Islands are considering building higher islands rather than.[146]

The Indonesian city of Jakarta is predicted to be severely impacted by sea level rise in the near future, and the construction of a 25 kilometer seawall protecting the city from being submerged under water is currently underway, as are plans to move the capital to another more safer location.[147]

However, SIDS will not only be affected by climate change in terms of rising sea levels, but also through coral bleaching, loss of biodiversity, more extreme weather events, food insecurity, lack of access to fresh water, and economic despair. A recent study suggests that due to increased flooding, many SIDS will run out of fresh water far before they are submerged,[148] making them uninhabitable by the mid-21st century, and stressing the urgency for adaptation in the region. Furthermore, food insecurity is expected to increase in many SIDS as fish stocks diminish, damages to infrastructure persist, and incomes decrease. In addition, SIDS are facing significant coral reef loss, with 50 percent of coral reefs in the Pacific region under threat.[149] Coral reefs are not only home to much of the region's biodiversity, they also serve as a protection against storms, reducing the cost of global storm damages by up to USD 4 billion annually.[150] This is especially important to SIDS, because a single extreme weather event can significantly impact their GDP. In 2015, Vanuatu was hit with Cyclone Pam, causing damages equivalent to 64 percent of the country's GDP,[151] while the recovery from cyclone Winston the following year cost Fiji 30 percent of their GDP.[152] According to the World Bank, natural disasters cost Pacific Island Countries 0.5-6.6 percent of their GDP on average per year, further demonstrating the financial impact that the islands' vulnerability has on the nations.[153]

What can be done to address this dangerous situation? Adaptation policies are being implemented around the world, but many are finding it difficult to keep up with the rate of change and the resulting impacts. Appropriate adaptation policies have been found to have a high rate of return, with research done by the Global Centre of Adaptation (2019) suggesting that investing in adaptation can generate benefits four times as great.[154] In Canada's province of Nova Scotia, for example, the provincial government has recognized the need to bring in stronger legislation for the protection of the coast's natural ecosystems and stricter management controls on infrastructure development in order to reduce risks and losses associated with sea-level rise, increased storminess, and greater exposure to erosion and flooding.

In the spring of 2019, a Coastal Protection Act was introduced which will be in effect throughout Nova Scotia within the coming years.[155] This new legislation will ensure that nature-based shoreline decision making is an essential element in managing the development along Nova Scotia's coasts. It is essential to ensure that planning

142 UNEP. 2014. Emerging Issues for Small Island Developing States: Results of the UNEP Foresight Process, United Nations Environment Program (UNEP), Nairobi, Kenya, June 2014, 55p. (https://sustainabledevelopment.un.org/con tent/documents/2173emerging%20issues%20of%20sids.pdf)

143 Handmer, J., & Nalau, J. (2019). Understanding loss and damage in Pacific Small Island developing states. In *Loss and Damage from Climate Change* (pp. 365-381). Springer, Cham.

144 Weir T, Virani Z (2011) Three linked risks for development in the Pacific Islands: climate change, disasters and conflict. Clim Dev 3:193–208

145 Foster, K. (2019, January 12). Many Small Islands, One Big Problem. Retrieved from https://harvardpolitics.com/world/many-small-islands/.

146 Global Commission on Adaptation. (2019). *Adapt Now: A Global Call for Leadership on Climate Resilience*.

147 Koch, W. (2019, September 16). Could a Titanic Seawall Save This Quickly Sinking City? Retrieved from https://www.nationalgeographic.com/news/energy/2015/12/151210-could-titanic-seawall-save-this-quickly-sinking-city/

148 Storlazzi, C. D., Gingerich, S. B., van Dongeren, A., Cheriton, O. M., Swarzenski, P. W., Quataert, E., ... & McCall, R. (2018). Most atolls will be un- inhabitable by the mid-21st century because of sea-level rise exacerbating wave-driven flooding. Science advances, 4(4), eaap9741.

149 Noda, K., Iida, A., Watanabe, S., & Osawa, K. (2019). Efficiency and sustainability of land-resource use on a small island. *Environmental Research Letters*, 14(5), 054004.

150 Beck, M. W., Losada, I. J., Menéndez, P., Reguero, B. G., Díaz-Simal, P., & Fernández, F. (2018). The global flood protection savings provided by coral reefs. *Nature communications*, *9* (1), 2186.

151 Thomas, A., Pringle, P., Pfleiderer, P., & Schleussner, C.-F. (2017). *Tropical Cyclones: Impacts, the link to Climate Change and Adaptation.* Climate Analytics.

152 Bhattarai, R., Ikimotu, H., Krishnamurthi, S., Bohane, H., Robie, D., Nakhid, C., … Pacific Media Watch. (2018, June 25). Asia Pacific Report. Retrieved from https://asiapacificreport.nz/2018/06/25/elisabeth-holland-climate-change- persistence-were-all-in-the-same-canoe/

153 The World Bank Group. (2017). *Pacific Possible. Pacific Possible* (p. 81). Washington, DC: International Bank for Reconstruction and Development / The World Bank.

154 Global Commission on Adaptation. (2019). *Adapt Now: A Global Call for Leadership on Climate Resilience.*

155 https://novascotia.ca/coast/

and development decisions are based upon current scientific information on the nature of the coast and its various sub-components and ecosystems. However, with continued inadequate global action on the control of greenhouse gas emissions in the atmosphere, these local and regional efforts are only stop-gap measures and they will have great difficulty in adapting to the pace of change that is occurring and will continue to occur as the impacts of global warning take place. In some parts of the world, wholesale evacuation of coastal areas is becoming more and more necessary as the im- pacts of climate change become more dangerous and uncontrollable.

The Paris Agreement target of limiting global surface warming to 1.5–2° C compared to pre-industrial levels by 2100 will still heavily impact the ocean. The 2018 IPCC report on the implications of a 1.5° C increase in global warming[156] sounds the alarm on what is evident around the world. Global efforts to control greenhouse gas emissions are failing to meet required levels of effort, targets are not being met, and the consequences for global coastal populations are moving to the highest level of threat. The report reinforces the dire consequences of even maintaining the current target of 2°C increase while demonstrating clear evidence that we are already experiencing the impacts of a 1°C increase and that substantial impacts are being felt in every region of the planet. The effectiveness of adaptation options comprising structural, physical, institutional, and social responses will depend largely on governance, political will, adaptive capacities, and the availability of finance.

The report also reaffirms the importance of linking adaptation to sustainable development, and that transformational adaptation requires an integrated approach rather than addressing current vulnerabilities as standalone climate problems.

The SROCC shows that adaptation will become even more important as many of the previously predicted consequences of climate change are reinforced and expected to increase over time.[157] The report also stresses the importance of adaptation and claims that the integration of local and indigenous knowledge in adaptation efforts have been beneficial.[158] Furthermore, the report underlines the benefits associated with an ecosystem-based approach (EbA) to adaptation, however, it does stress that this method assumes that that the climate can be stabilized and that EbA has limitations that are hard to determine at this point in time.[159]

156 IPCC. (2018). *Global Warming of 1.5°C*, Special Report of the Working Group I Technical Support Unit, Intergovernmental Panel on Climate Change [Core Writing Team, R.K. Pachauri and L.A. Meyer (eds.)]. IPCC, Geneva, Switzerland, 55 p.
157 IPCC, SROCC, 2019. Chapters 3, 3.2, 3.3; and Chapter 5, 5.2, 5.4
158 IPCC, SROCC, 2019. Section A7 SPM 16
159 IPCC, SROCC, 2019. Section 5.5.2.1

Investing in climate change adaptation efforts has become increasingly common, especially following the introduction of the Global Commission on Adaptation's 2019 flagship report, *Adapt Now: A Global Call for Leadership on Climate Resilience*. The report stresses the importance of international collaboration around adaptation and global leadership for climate resilience.[160] The Least Developed Countries Fund (LDCF) and the Special Climate Change Fund (SCCF) have invested US$1.5 billion into 330 adaptation projects and programs around the world.[161] The United Nations Development Programme (UNDP) is through its 'Climate Promise' Program scaling up its support to climate actions across the globe. This includes US$3 billion in funding for climate action in over 100 countries in the next decade.[162] Furthermore, in 2019 the European Union pledged 30.7 billion towards strengthening disaster risk management in the Caribbean.[163] In 2017, Fiji announced its Environment and Climate Adaptation Levy (ECAL) which includes a 10 percent income tax on the rich as well as a 10 percent tax on luxury items like yacht charters and sportscars.[164] The revenues of the tax will then be used for climate change adaptation and mitigation projects across the country.[165] Canada, on the other hand, introduced its US$18 million five-year initiative called Building Regional Adaptation Capacity and Expertise (BRACE) Program (2017–2022) which focuses on providing funding for regional and local adaptation and mitigation efforts.[166]

In 2013, the European Commission adopted an EU strategy on adaptation to climate change, which aims to enhance the preparedness and capacity of all governance levels to respond to the impacts of climate change in Europe by taking a coherent approach and providing for improved coordination. The Commission published an evaluation of the strategy in November 2018, accompanied by a public consultation from December 2017 to March 2018. The evaluation provided lessons learned and reflections on improvements for future action as well as a staff working document presenting the full

160 Global Commission on Adaptation, n. 139 above.
161 GEF, GEF Programming Strategy on Adaptation to Climate Change for the Least Developed Countries Fund and the Special Climate Change Fund and Operational Improvements, July 2018 to June 2022. 2018. Available online: <https://www.thegef.org/sites/default/files/council-meeting-documents/EN_GEF.LDCF_.SCCF_.24.03_Programming_Strategy_and_Operational_Policy_2.pdf>.
162 H.R. Hassan and V. Cliff, "For small island nations, climate change is not a threat. It's already here," (September 24. 2019). available online: <https://www.weforum.org/agenda/2019/09/island-nations-maldives-climate-change/>.
163 European Union, EEAS. "Euro 30 Million to Help Caribbean Enhance Climate Resilience and Adaptation," (January 31, 2019), available online: <https://eeas.europa.eu/delegations/guyana/57472/euro-30-million-help-caribbean-enhance-climate-resilience-and-adaptation_en>.
164 Government of Fiji, ECAL in Action: How Your Environment and Climate Adaptation Levy is Building a Better, Stronger Fiji. [PowerPoint slides] (2019), available online: <https://www.fiji.gov.fj/getattachment/e71b8d61-ce72-48fc-bca2-eeeff2d8739b/Environment-Climate-Adaptation-Levy.aspx>.
165 Ibid.
166 Natural Resources Canada, Building Regional Adaptation Capacity and Expertise (BRACE) Program, (July 25, 2019). Available online: <https://www.nrcan.gc.ca/climate-change/impacts-adaptations/what-adaptation/building-regional-adaptation-capacity-and-expertise-brace-program/21324>.

evaluation. The evaluation showed that the strategy has delivered on its objectives, with progress noted for each of eight individual actions. The evaluation also suggested areas where more work needs to be done to prepare vulnerable regions and sectors.[167]

Furthermore, as part of the European Green Deal, the European Commission adopted its new EU strategy on adaptation to climate change on 24 February 2021. The new strategy sets out how the European Union can adapt to the unavoidable impacts of climate change and become **climate resilient by 2050.** The Strategy has four principle objectives: to make adaptation smarter, swifter and more systemic, and to step up international action on adaptation to climate change.

Ocean related actions proposed under this Strategy include the following:

- As part of the reporting process of the functioning of the Common Fisheries Policy, the Commission will assess how this policy caters for climate change adaptation. It will consider, among other aspects, how the CFP caters for the large-scale changes in marine ecosystems that are likely to stem from climate change, looking at both mitigation and adaptation needs. In this framework, the Commission has launched two studies to assess possible impacts of climate change on the policy and how it can be made more resilient to forthcoming impacts while mitigating the climate footprint of fishing and post-harvest activities.
- The EU will include climate change considerations in the future agreement on the conservation and sustainable use of marine biodiversity of areas beyond national jurisdiction (BBNJ). It will also engage with regional fisheries management Organizations, including the Commission for the Conservation of Antarctic Marine Living Resources, to promote adaptation and new marine protected areas.
- Nature-based solutions are at the core of this Strategy as they are essential for sustaining healthy water, oceans and soil. Implementing nature-based solutions on a larger scale would increase climate resilience and contribute to multiple Green Deal objectives. Blue-green (as opposed to grey) infrastructures are multipurpose, "no regret" solutions and simultaneously provide environmental, social and economic benefits and help build climate resilience. For example, protecting and restoring wetlands, peatlands, coastal and marine ecosystems.

167 European Commission (2018) Evaluation of the EU strategy on adaptation to climate change. https://ec.europa.eu/clima/policies/adaptation/what_en

- In coastal and marine areas, nature-based solutions will enhance coastal defence and reduce risk of algal blooms. Simultaneously, they will provide benefits such as carbon sequestration, tourism opportunities, and biodiversity conservation and restoration.
- Ocean measurements and observation will also be further strengthened. The Commission will help to close knowledge gaps on climate impacts and resilience, including on oceans, through Horizon Europe, Digital Europe, Copernicus and EMODnet.

A report produced by Ricardo and GIZ GmbH addressed the connection between the NDC and the National Adaptation Plan (NAP) process in order to combine efforts in mainstreaming the multilateral framework on climate action in place since 2015. From 17 May 2017, a total of 140 NDCs (165 INDCs) (on behalf of 145 countries) were submitted to the UNFCCC, of which 104 NDCs (145 INDCs) included adaptation. Of these 39 NDCs (55 INDCs) specifically refer to the NAP process as being planned or already in progress. However, the Least Developed Countries Expert Group (LEG) to the UNFCCC has reported that 85 countries, including 45 LDCs have actually begun the process. As of 17 May 2017, most of the 145 countries that ratified the Paris Agreement made minor or no change to adaptation-related content in their NDCs and are now considering how NDC adaptation goals can be operationalized through implementing existing national adaptation strategies and plans or how developing national adaptation planning processes could support NDC implementation. [168]

Among its key messages, the report states that:

1. Linking the NDCs to the NAP process can accelerate enhanced adaptation action. Many countries consider the NAP process as the backbone of national adaptation planning and action, regarding it beneficial to link, and thus strengthen, the formulation and im plementation of NDC adaptation components to the NAP process.
2. By including adaptation in (I)NDCs and formulating adaptation goals at national level, the profile of adaptation has been raised on the national agenda.

Even under a climate stabilization scenario of 1.5°C, adaptation to sea-level rise remains essential in coastal areas.[169] Coastal adaptation to restore natural eco- systems, such as rebuilding coastal dunes, planting

168 Smithers, R., K. Shabb, E. Holdaway, N. Sanchez Ibrahim N. Rass, and J. Oliver (2017) The Role of the NAP Process in Translating NDC Adaptation Goals into Action: Linking NAP processes and NDCs. https:// www.adaptationcommunity.net/wp-content/uploads/2018/09/The-Role-of-the-NAP-Process-in-Translating-NDC-Adaptation-Goals-in-to-Ac- tion.-Linking-NAP-processes-and-NDCs_final_korrigiert-20180918.pdf

169 Nicholls, R.J. et al. (2018) Stabilisation of global temperature at 1.5^{0}C and 2.0^{0}C: implications for coastal areas, Philosophical Transactions A, 376 (2119).

mangrove forests, restoring estuarine wetlands, supports SDGs for enhancing life and livelihoods on land and oceans. The report recommends the adoption of EbA including such measures as mangrove restoration to reduce coastal vulnerability to storm surges, flooding and erosion; protecting marine and terrestrial ecosystems; as well as watershed management to reducing terrestrial flood risks and improving water quality.

In India, the Ministry of Environment, Forest and Climate Change with support from UNDP announced a 6-year project 'Enhancing Climate Resilience of India's Coastal Communities' (2019-2024), which will take an ecosystem-centered and community-based approach to adaptation and include women in the process. The project aims to increase the resilience of coastal communities in the country by investing in adaptation efforts ranging from more climate-resilient infrastructure to ensuring that climate change is accounted for in planning and governance of coastal zones. [170]

In West Africa, UN Environment is implementing the largest natural resource development project in the history of The Gambia to help the nation deal with climate change impacts and restore degraded forests, farmland and coastal zones. Launched in January 2018, funded by a USD 20.5 million Green Climate Fund (GCF) grant and USD 5 million from the Government of the Gambia, the "Large-scale Ecosystem-based Adaptation Project in The Gambia" is using large-scale EbA, which is considered a cost-effective and low-risk approach to adaptation. The project aims to develop the climate-resilience of rural Gambian communities and facilitate the building of a sustainable natural resource-based economy within and next to agricultural land, community-managed forest reserves and wildlife conservation areas.[171]

These measures are typically more supportive of SDGs, especially when they are combined with participatory decision-making processes that promote equity and sustainability. The report urges the inclusion of indigenous peoples and local knowledge, to ensure that adaptation encompasses the poor and other vulnerable populations. Within this context, community-based adaptation (CbA) enhances resilience and the long-term sustainability of adaptation plans. As the impacts of climate change become ever more evident and destructive, the limits to coastal adaptation are increasingly evident in low-lying islands in the Pacific, Caribbean, and Indian Ocean, where population relocation and migration are becoming more and more imminent. Synergistic outcomes between development and relocation of coastal communities are enhanced by participatory decision-making and settlement designs that promote equity and sustainability.

A number of studies have demonstrated that the ocean and NDCs that integrate adaptation and mitigation efforts in relation to oceans are not being given the appropriate level of attention and concern.[172] [173] A recent paper by Gattuso *et al.*[174] states that while most mitigation and adaptation efforts are land-based, more is needed to identify ocean-based measures as well. The authors undertake an assessment of 13 global- and local-scale, ocean-based measures to help steer the development and implementation of technologies and actions toward a sustainable outcome. Some of the measures include adaptation measures to help offset degradation to highly vulnerable ocean ecosystems, including coral reefs, ocean vegetation and seagrass beds, and Arctic biota. There is little doubt that increased efforts are going to have to be made both on land and in the ocean in order to be able to adapt effectively to a rapidly deteriorating environment in which coastal hazards and ocean ecosystem degradation will continue to exacerbate as the immediate impacts of climate change continue.

A paper prepared by the Government Offices of Sweden, Ocean Conservancy, and Climate Advisers, identified four key climate-ocean linkages, specified several actions that are needed, and set forth options that might be pursued by concerned Parties.[175] One of the identified linkages states that:

"Protecting coastal and marine ecosystems against the adverse effects of climate change is vital for human and ecosystem adaptation and, in many cases, also contributes to reduction of emissions. Reducing anthropogenic stressors on the oceans, such as overfishing and other unsustainable exploitation of marine resources, habitat degradation, pollution and nutrient runoff, may also enhance the ocean's capacity to absorb the impacts of climate change."[176]

The necessary actions that address this linkage include: increased ocean-related adaptation, including through creation of a comprehensive network of "climate smart" marine protected areas designed to safeguard ocean resilience, coral reef protection, and integrated coastal

170 UNDP Climate Change Adaptation. (n.d.). Enhancing Climate Resilience of India's Coastal Communities: UNDP Climate Change Adaptation. Retrieved from https://www.adaptation-undp.org/projects/enhancing-climate-resilience-india's-coastal-communities.
171 UN Environment (2018) In *The Gambia, building resilience to a changing climate*. https://www.unenvironment.org/news-and-stories/story/gam-bia-building-resilience-changing-climate.

172 Gallo, N., D.G. Victor, and L.A. Levin (2017) Ocean commitments under the Paris Agreement. Nature Climate Change 7:833-838.
173 Stevns, S.-J. and T. Robb-McCord (2018) In Raising NDC Ambition, Oceans Need Their Chance. http://ndcpartnership.org/news/raising-ndc-ambition- oceans-need-their-chance
174 Gatusso et al. (2018) Ocean solutions to address climate change and its effects on marine ecosystems, Frontiers in Marine Science, 04 October 2018, https://www.frontiersin.org/articles/10.3389/fmars.2018.00337/full.
175 Government Offices of Sweden, Ocean Conservancy, and Climate Advisers (2018) Climate Change and the Ocean: Key Linkages, Needed Actions, and Options for Further Steps. https://cop23.com.fj/wp-content/uploads/2018/09/ Options-Paper-Friends-of-the-Ocean-Bangkok.pdf
176 Ibid.

zone management; increased funding for ocean-related adaptation; increased awareness and highlighting of the linkage; and stronger recognition and inclusion of coastal and marine ecosystems in landscape approaches.

A 2019 report from Because the Ocean[177] makes the point that in addition to climate impacts, ecosystems and ecosystem services are under threat from human activities, such as pollution, overfishing and coastal construction. These activities pose serious risks for ecosystem functioning and need to be addressed in alignment with adaption to climate change impacts. The Because the Ocean Secretariat highlights that marine ecosystems are under anthropogenic pressures like coastal construction and overfishing, as well as impacts related to climate change. Therefore, adaptation strategies need to be developed in combination with efforts to reduce the threats imposed by human activities. Reserves, parks, sanctuaries, and marine protected areas (MPAs) will according to the report be important adaptation tools for the long-term sustainability of biodiversity and ecosystem services.

The report identifies Marine Protected Areas (MPAs), parks, reserves and sanctuaries as important adaptation tools designed to improve the long-term conservation of marine ecosystems and their biodiversity and can also provide co-benefits to climate mitigation where they protect or enhance blue carbon systems. Incorporating existing and projected climate impacts into MPA criteria can result in "Climate-smart" MPAs that can enhance their role in promoting climate resilience of marine ecosystems, and their sustainability in the face of anticipated environmental change. The report supports the IPCC SROCC recommendation on the development of hybrid adaptation approaches, in which both mitigation and adaptation measures are incorporated to build more effective climate resilience; "according to the IPCC, climate resilience depends on combining mitigation and adaptation. Since mitigation reduces the rate as well as the magnitude of warming, it also increases the time available for adaptation to a particular level of climate change, potentially by several decades. Delaying mitigation actions may thus reduce options for both mitigation and adaptation in the future, as greater rates and magnitude of climate change increase the likelihood of exceeding adaptation limits. Successful adaptation in the longer term, therefore, de- pends on effective mitigation." [178]

Within the UNFCCC, efforts are currently underway to identify knowledge gaps in adaptation related to the ocean, coastal areas and ecosystems, under the Nairobi Work Programme (see Box 2). Also, under the auspices of the 6th Assessment Report that is in progress, the IPCC Working Group II is preparing a report entitled "Impacts, Adaptation and Vulnerability" which will be released in February 2022[179]. The key focal points of the report will include:

- The significance of sectoral and regional climate risks to natural and human systems and their interactions in the context of culture, values, ethics, identity, behaviour, historical experience, and knowledge systems (e.g., indigenous and local)
- The climate risk framework used in this report encompassing hazard, exposure, and vulnerabilities, including their spatial distribution, cascading impacts, disaster risk reduction, and risk uncertainties
- The significance of adaptation, in addressing climate change risks, including diverse adaptation responses, technologies including nature and ecosystem-based adaptation, outcomes, common principles, resilience, and issues of scale
- Detection and attribution of climate impacts and methods to evaluate adaptation responses
- Understanding dynamic climate risks from scenarios that reflect multiple interacting drivers
- Scientific, technical and socioeconomic aspects of current and future residual impacts of climate change, including residual damage, irreversible loss, and economic and non-economic losses caused by slow onset and extreme events
- Limits to adaptation, and enabling conditions for effective adaptation including governance, institutions, and economic aspects
- Climate change responses and their interactions with sustainable development, including adaptation with mitigation co-benefits and trade-offs
- Opportunities for enhancing climate resilient development pathways

This report will be a major overview and current update on all aspects of climate change adaptation, as well as a comprehensive global and regional assessment.

In a recent chapter in the 2021 Ocean Yearbook, Ganslandt and Ricketts[180] provide an assessment of the range and scope of actions that are being undertaken globally and identify developing trends within the

177 Because the Ocean Secretariat, 2019. Ocean for Climate: Ocean-related Measures in Climate Strategies (Nationally Determined Contributions, National Adaptation Plans, Adaptation Communications and National Policy Frameworks); https://www.becausetheocean.org/ocean-for-climate/
178 Ibid., p.36

179 https://www.ipcc.ch/report/sixth-assessment-report-working-group-ii/
180 Ganslandt, E. and P. Ricketts (2021) Adaptation of the Ocean, Coastal Areas and Ecosystems, Ocean Yearbook 35, Koninklijke Brill, NY, Part 2 Climate Change Trends and Responses, pp. 87-147

Box 2. UNFCCC Scoping Paper on the Topic of Adaptation Knowledge Gaps on the Ocean, Coastal areas and Ecosystems[1]

A UNFCCC Scoping Paper on the Topic of Adaptation Knowledge Gaps on the Ocean, Coastal areas and Ecosystems has been prepared in response to the UNFCCC SBSTA mandate to prioritize the thematic area of the ocean under the NWP in 2019. Knowledge gaps may exist that hinder the development of adaptation strategies, especially for LDCs and SIDS. Sharing knowledge and practices regarding adaptation more systematically could help to close some of these gaps. This Box highlights several sections of the Scoping Report relevant to challenges and private sector initiatives in adaptation.

Section 4 reviews what is currently being done in adaptation and discusses what has been most effective so far. In discussing current practices regarding support to strengthen adaptation knowledge, the paper distinguishes between funding support, technical and technological support, and human support.

With regards to funding support, the paper highlights international donors like the World Bank and the Asian/African/ Caribbean Development Banks (ADB, AfDB, CDB) as strong mechanisms for building resilience efforts in developing countries and regions. It mentions the scaling up of international climate finance to focus on adaptation by funds like the Green Climate Fund (GCF), the Adaptation Fund, and the Special Climate Change Fund. It also discusses the innovative approach of Blue Bonds whereby funding towards environmental practices is backed by international organizations and funds. The other major innovative mechanism mentioned in the paper was the insurance sector. It cited the new Blue Natural Capital Financing Facility that "funds bankable projects and businesses with clear climate change adaptation/mitigation impacts that include NBS in coastal areas." If successful, this practice could incentivize private insurance entities to aid in sustainable development projects aimed at nature-based adaptation solutions.

Regarding technical and technological support, the paper focuses on the shift from a strict engineering/infrastructure approach to one that considers a multitude of options. With the evolution of NbS along with non-structural measures and hybrid measures, there now exists four major strategies for adaptation that can be implemented depending on a region's unique situation and preference.

Regarding human support, the paper references the Regional Technical Support Mechanism (RTSM) in the Pacific, which provides technical advice and information from a "registered network of pre-approved experts" on project development, re- source allocation, etc.

In discussing Approaches and Mechanisms, the paper touches on coordinated cross-sectional and regional approaches, EbAs, CbAs, and the Blue Economy. The paper applauds the EU and the Caribbean Community (CARICOM) as exemplary regional models, and cites Coastal Adaptation EU as a solid model for connecting regional plans with local implementation. The Ecosystem-based approach section discusses the importance of Integrated Coastal Zone Management (ICZM), MSP, and MPAs in adaptation plans. The CbA section focuses on the Locally-Managed Marine Area Network (LMMA) which is connecting local practitioners and developing best practices for smaller scale projects that factor in cultures and traditions. The Blue Economy section focuses on the development of the Blue Economy particularly in Africa and the Caribbean, and maintains that the concept will define the future of developing regions.

Priority areas for adaptation are defined as: highly populated mega-deltas, SIDS, coastal and delta cities, critical coastal and marine ecosystems, fisheries and other sectors, and the outer limits of maritime zones and boundaries.

Section 5 explains a Knowledge-to-Action methodology for determining where the knowledge gaps exist and how to mitigate them. The methodology requires defining knowledge needs, scoping, engagement with expert groups, refining knowledge, co-designing actions, reporting and disseminating findings, facilitating partnerships, and tracking and learning. Knowledge gaps exist in six topics essential to adaptation: governance and participation; data and methods; technology and innovation; restoration; capacity building and education; and finance. The scoping report lays out several gaps and good practices associated with these six topic areas, and further breaks down possible actions at the global, regional, national, and sub-national levels.

The gaps and good practices laid out in the scoping report are a first attempt to be continued during the 13th Focal Point Forum at COP25 and beyond by the NWP. Thematic information on the ocean together with the good practices will be continuously available on the UNFCCC Knowledge-to-Action NWP Adaptation Knowledge Portal.

1 UNFCCC. (2019). Adaptation of the Ocean, Coastal Areas and Ecosystems - Scoping Paper on the topic of adaptation knowledge gaps on the ocean, coastal areas and ecosystems; https://unfccc.int/documents/230928

context of the oceans-climate change nexus. Drawing on previous ROCA reports and numerous other sources, this article is dedicated to the memory of Dr. Biliana Cicin-Sain, founder of the Global Ocean Forum and chief architect of the Roadmap to Ocean and Climate Action. Part of the article provides a series of examples of adaptations organized by ocean regions, namely the Indian Ocean/Bay of Bengal, Pacific Ocean, Atlantic Ocean, Caribbean Sea, Arctic Ocean, and Mediterranean Sea/Black Sea/Europe (see Table 1).

5.2 Adaptation responses in management of marine ecosystems, fisheries and aquaculture

Marine spatial planning (MSP) is not yet widely seen as a part of climate adaptation strategies, but provides opportunities for integrating climate change into ocean planning processes, which consider and attempt to reconcile multiple human demands on marine spaces. However, climate change is often neglected as a factor in MSP processes, with some notable exceptions such as Netherlands, United Kingdom, Sweden, Rhode Island in the United States, Abu Dhabi in the United Arab Emirates, and the Seychelles, all of which incorporate climate change into MSP. In addition, the Declaration for Sustainable Fisheries and Aquaculture of the FAO Committee on Fisheries supports the implementation of marine spatial planning approaches noting the growing external pressures in aquatic systems, such as climate change, biodiversity loss and increased competition for the use of marine and coastal areas.[181] With this background, a recent study[182] argues that MSP must become 'climate-ready'. The first step is to build evidence at multiple scales on the pathways through which climate impacts on marine social-ecological systems will challenge ocean planning. This involves identifying in advance potential places in which human activities and infrastructure are more vulnerable and exposed to climate impacts, keeping in mind differences among human communities' capacity to cope, respond or adapt to climate challenges. Second, there is a need to better understand the robustness of different management approaches under climate uncertainty. Thus, countries with ongoing MSP initiatives must evaluate which dynamic solutions suit them better and why, providing both for flexibility and predictability for ocean users. Third, the implementation of global ocean sustainability goals requires the effective coordination of different policy arenas, including MSP policies and climate policies. There is an ongoing need to better integrate MSP and marine governance in general into climate adaptation strategies.

As the climate changes, communities need to adapt to build social, ecological, and economic resilience. No adaption (doing nothing) is costly. It is essential to identify effective adaptation strategies, appropriate to specific settings that take advantage of ecosystem structures and processes that form the basis for life-sustaining ecosystem services. Conservation International along with the Green-Gray Community of Practice has published a guide to implementing green-gray infrastructure. The guide highlights the need to combine "green" ecosystem conservation and restoration with "gray" conventional engineering approaches – using a hybrid green-gray approach. An example of green-gray infrastructure is where natural coastal ecosystems – such as mangroves, salt marshes, inter-tidal flats, seagrasses, and coral reefs – are combined with gray infrastructure such as breakwaters, to combine the values of wave attenuation and flood control of natural ecosystems with the benefits of engineered structures. The guide provides several case studies from marine and coastal areas that include restoration of coastal habitats and design innovations for erosion control and storm protection.[183]

Many marine animals are highly sensitive to ocean warming, responding quickly and often predictably particularly through changes in spatial distribution. Changes at sea have been faster than those been observed on land. In response, individual fishers and entire fleets are moving to new locations, catching new species, or facing the challenges of lost fishing opportunities and livelihoods locally and regionally. Movements of fisheries across political boundaries are particularly challenging and have led to conflict in many cases. Adaptation to climate change requires fisheries management to take into account climate-related changes in species distribution and productivity. A recent FAO technical report has concluded that effective fisheries management is the first foundation of climate-resilient fisheries and summarized a set of good practice adaptation measures based upon transferable experiences and lessons learned from case studies across the globe to showcase how flexibility can be introduced into the fisheries management cycle to foster resilience to climate change and related disasters.[184] Other adaptation options include well-designed rights-based or secure-access fisheries, ecosystem-service accounting

181 FAO. 2021. 2021 COFI Declaration for Sustainable Fisheries and Aquaculture. Rome. https://doi.org/10.4060/cb3767en

182 Santos, C.F., Agardy, T., Andrade, F., Calado, H., Crowder, L.B., Ehler, C.N., García-Morales, S., Gissi, E., Halpern, B.S., Orbach, M.K. and Pörtner, H.O. (2020) Integrating climate change in ocean planning. *Nature Sustainability*, 3(7), pp.505-516.

183 Green-Gray Community of Practice. (2020). Practical Guide to Implementing Green-Gray Infrastructure. Available online at https://www.conservation.org/projects/global-green-gray-community-of-practice

184 Bahri, T., Vasconcellos, M., Welch, D.J., Johnson, J., Perry, R.I., Ma, X. & Sharma, R. (2021). Adaptive management of fisheries in response to climate change. FAO Fisheries and Aquaculture Technical Paper No. 667. Rome, FAO. 300 pp. http://www.fao.org/3/cb3095en/cb3095en.pdf

Table 1: Regional Examples of Adaptation Measures (from Ganslandt and Ricketts, 2021)

Indian Ocean/ Bay of Bengal	Pacific Ocean	Atlantic Ocean	Caribbean Sea	Arctic Ocean	Mediterranean Sea/ Black Sea/ Europe
Construction of Cyclone Shelters and Embankments: *Bangladesh* National project to construct shelters and embankments in locations calculated using the height of storm surges and the intrusion of stormwater to protect animals, humans, and property during the tropical storm season and obstruct surge water from penetrating coastal communities. **Governance Approaches through Integrated Coastal Zone Management (ICZM):** *India* Comprehensive national ICZM policy under development by the Government of India with funding support from the World Bank to: include the establishment of a National Centre for Sustainable Coastal Management and development of state ICZM plans, initially with three pilot states: aims are: 1) security of lives and property/assets in disaster-prone coastal zones, 2) conservation, preservation, restoration and development of coastal resources and ecosystems, 3) security of livelihood of coastal communities and overall food security, 4) security of cultural and heritage sites, and 5) goals of sustainable national development and growth.	**Raising Land Elevations:** *Marshall Islands* Exploring raising the elevation of the islands as a protection against sea-level rise and storm surges. ***Indonesia - Jakarta*** 25 km seawall is under construction to protect the city from being submerged due to the combination of sea-level rise and subsidence. Indonesia is moving its capital city out of Jakarta due to the increasing risks from climate change. **Taxation and Trust Fund Development to Finance Adaptation and Mitigation Action** ***Fiji*** Environment and Climate Adaptation Levy (ECAL): Announced in 2017, ECAL includes a 10 percent income tax on the rich as well as a 10 percent tax on luxury items like yacht charters and sport cars: as of 2019 more than FJ$255 million (about US$117 million) collected has been spent on 102 different mitigation and adaptation projects across the country; given Fiji's vulnerability to climate change, the government intends to start allocating a certain percentage of the ECAL revenues to a Climate Change Relocation Trust Fund which can be used in the case that vulnerable communities within the country need to be relocated	**Climate Change and Coastal Data and Information Centers:** *European Union* MyCOAST Project 2017–2020: Climate change coastal observatory to provide support and climate services for economic activities for the EU Atlantic coast: focus is on adapting both infrastructure and current practices to increasing effects of climate change. **Coastal Flood and Erosion Control to Protect Low-lying Urban Areas** *United Kingdom* The Thames Estuary 2100 Project: Flood risk management project started in 2010 to protect London and the tidal reaches of the River Thames from: a potential 1.9 m rise in sea level under the highest scenario predictions, and increased frequency and severity of North Sea storm surges and water drainage from the Thames basin. Community-based Coastal Adaptation and Conflict Management ***United States, New England*** New England Climate Adaptation Project: Developed by university researchers with partner communities to address coastal conflict by: building community risk literacy, optimism and collaborative problem-solving capacity to take action; joint fact-finding, scenario planning, negotiating trade-offs, facilitated public dialogue and forums, and securing support for collaborative adaptation	**National Adaptation Strategies:** *Haiti* **National Adaptation Programme of Action (NAPA):** Example of strategies in the Caribbean region that have identified priority sectors for adaptation as being coastal zones, freshwater resources and agriculture: other important overlapping sectors that are vulnerable to the impacts of climate change are tourism, human health, biodiversity and fisheries. ***Dominica*** Climate Resilience Execution Agency of Dominica (CREAD): A national strategy under a 2018 Climate Resiliency Act to make Dominica the world's first "Climate-Proof" country after Hurricane Maria destroyed 90 percent of structures in 2017 following devastating hurricanes in 2015, 2013 and 2010: reconstructing with hurricane-proof buildings diversifying the economy high-end tourism locally grown, sustainable agricultural system banning plastics to reduce trash, litter, and pollution	**Indigenous and Community-based Adaptations to Hunting and Subsistence Practices:** *Canada and U.S./Alaska* Following the International Polar Year (2008–2009), the literature on adaptation efforts in the Arctic shows that: Arctic indigenous communities have had to significantly adapt to climate change, such as when and how they hunt. between 2003 and 2013, 48 percent of 157 documented adaptation initiatives were undertaken in the hunting and subsistence harvesting sector, reflecting adaptations in Indigenous communities. **Traditional Knowledge Strategies:** ***Canada*** The National Inuit Climate Change Strategy: Action plan for Canada's 65,000 Inuit, the majority of whom live in Inuit Nunangat, which makes up nearly one-third of Canada's landmass and 50 percent of its coastline: five priority areas for climate action: 1) knowledge and capacity-building; 2) health, well-being, and the environment; 3) food systems; 4) infrastructure; and 5) energy.	**Protection of Coastal Cities from Sea-Level Rise and Reduced Water Supply:** *Egypt* The vulnerability of Egyptian coastal cities means adaptation measures are of great importance: the areas deemed most vulnerable to climate change are aquaculture and fisheries, agriculture, water resources, coastal zones, human settlement, and water supplies Coast Protection: 30 percent of Alexandria could be lost to flooding if no actions are taken Water Management: Egypt gets 95 percent of its water supply from outside its borders: - adaptation measures include increased abstraction of groundwater, desalination, improved rain harvest technology, and more efficient transportation and personal use of water. ***Italy*** Venice's "Moses" Project: The "Moses" barrage system became operational in July 2020 when the 78 barriers were raised for the first time: the 3 m high barriers (designed some 40 years ago) may be now too low given recent rates of sea-level rise in the Adriatic due to climate change.

that emphasizes conservation benefits, climate-effective area-based management tools such as MPAs and other effective area-based conservation measures (OECMs), and the modification of social norms. The FAO Adaptation Toolbox guides fisheries and aquaculture-dependent communities, countries and other key stakeholders in their adaptation efforts.[185] According to the Adaptation Toolbox, adaptation strategies must include institutional adaptations (e.g., legislation or policy to support climate risk proofing of large-scale grey infrastructure), measures addressing livelihoods (e.g., livelihood diversification and alternatives to support vulnerable communities), and measures intended to manage and mitigate risks and thereby strengthen

185 Barange, M., Bahri, T., Beveridge, M.C.M., Cochrane, K.L., Funge-Smith, S., and Poulain, F. (2018). Impacts of climate change on fisheries and aquaculture - Synthesis of current knowledge, adaptation and mitigation options. FAO Fisheries and Aquaculture Technical Paper 627. Rome. 628 pp. http://www.fao.org/3/i9705en/i9705en.pdf

resilience (e.g., risk transfer mechanisms such as social protection and insurance).[186] Adaptation solutions need political commitment, stakeholder participation, technological innovation and behavioural change to succeed. In addition, the use of economic appraisal and decision-support tools to assess the costs and benefits of adaptation options is key to identify the most appropriate adaptation interventions, including no- and low-regret actions, addressing potential lock-in, and early planning for long-term adaptation.[187]

Fishers and communities are able to adapt their behaviors and businesses, particularly when armed with knowledge of probable reconfigurations of species available on the fishing grounds they visit and may pursue novel collective adaptation strategies such as Community Supported Fishing (CSF). Another area for climate adaptation is in cooperative management across political boundaries for species likely to cross those boundaries, including sharing of data and science, tradeable permits/quota or dynamic allocation systems. These solutions require improved coordination of management among countries.[188]

The FAO has produced guidance for addressing fisheries and aquaculture in NAPs, as a supplement to the UNFCCC NAP Technical Guidelines.[189] The guidance is intended for policymakers and government officers responsible for NAP planning and processes generally, as well as fisheries and aquaculture officers at country level. It collates and analyses relevant information from fisheries and aquaculture to support the sector's ability to take part in national climate change adaptation planning processes. In addition, the NAP-Ag Knowledge Tank[190] provides complementary tools and resources as guidance to the steps that form the formulation and implementation of the NAPs.

New data and information resources have also become available for the management of fisheries and other marine species. For example, OceanAdapt[191] is one example that displays animated maps online for more than 500 marine species around North America, while Redmap[192] is a similar effort in Australia that includes citizen observations.

5.3 Summary of achievements and future needs on adaptation

Much progress has been made in incorporating ocean-related issues and management actions into NDCs during recent years. Marine, and in particular coastal, ecosystems and their vulnerability are also widely incorporated into NAPs, although these plans often lack specificity. However, very few current MSP efforts integrate climate change, rendering those plans less effective in building ecosystem resilience and more prone to result in new conflicts between ocean users. This also highlights the existing divide between ocean and climate policies at the national level.

There is still a need to better understand how specific marine and fishery management tools and approaches, as well as their supporting policies and legislation, can be adapted to a changing ocean, and how they can best support vulnerable coastal communities. Countries differ in their socio-ecological situations, and their response options will also likely be unique. Systematic monitoring and adaptive management at the national level is important for determining what existing and new tools might best work for adapting to climate impacts, along with reducing other human impacts. Newly available technical guidance, such as the FAO guidance for addressing fisheries and aquaculture in NAPs, will be helpful. Countries will also need increased finance and technical assistance to prioritize adaptation options at different timescales. All climate-ocean adaptation options also rely on better coordination and information exchange amongst institutions and ministries, both nationally and between countries.

186 Poulain, F., Himes-Cornell, A., and Shelton, C. (2018). Methods and tools for climate change adaptation in fisheries and aquaculture. In: Barange, M., Bahri, T., Beveridge, M.C.M., Cochrane, K.L., Funge-Smith, S., and Poulain, F. (eds.) 2018. Impacts of climate change on fisheries and aquaculture - Synthesis of current knowledge, adaptation and mitigation options. Chapter 25. FAO Fisheries and Aquaculture Technical Paper 627. Rome. 628 pp. http://www.fao.org/3/i9705en/i9705en.pdf

187 Watkiss, P., Ventura, A., and Poulain, F. (2019). Decision-making and economics of adaptation to climate change in the fisheries and aquaculture sector. FAO Fisheries and Aquaculture Technical Paper No. 650. Rome, FAO. http://www.fao.org/3/ca7229en/CA7229EN.pdf

188 Ibid

189 Brugere, C. and De Young, C. 2020. Addressing fisheries and aquaculture in National Adaptation Plans. Supplement to the UNFCCC NAP Technical Guidelines. Rome, FAO. Online at http://www.fao.org/policy-support/tools-and-publications/resources-details/en/c/1401996/

190 Available at www.fao.org/in-action/naps/knowledge-tank

191 http://oceanadapt.rutgers.edu

192 http://www.redmap.org.au/

6. LOW CARBON BLUE ECONOMY

6.1 International developments to advance blue economy practices

The blue economy has come to signify international interest in the growth of ocean-based economic development in a manner that is both environmentally sustainable and socially equitable. However, the meaning of these terms, and the manner in which they are applied, are still open to interpretation.[193] While blue economy transitions have become the cornerstone of many countries' efforts to implement SDG 14 - with co-benefits to other SDGs - their focus is not solely on low-carbon sectors. Many national blue economy plans incorporate existing sectors such as fisheries, aquaculture, tourism and maritime transport, but also extractive sectors such as oil and gas. Some countries are also actively innovating in the development of new sectors that include renewable ocean energy, blue carbon sequestration, and marine biotechnology. However, they may also include high carbon sectors such as deep-sea mining. For a blue economy to also contribute towards CO_2 emissions reduction, its focus needs to be on transitioning towards low-carbon environmentally sustainable technologies that can help build climate resilience in the long term through providing for local economic opportunities based on healthy marine ecosystems. Towards this end, there is a need for further discussion and innovation around how, and if, specific sectors and activities can be made environmentally sustainable and low carbon, and if they cannot, what alternatives are available. Low-carbon blue economy transitions require new finance, which is also discussed in this section.

Transitioning towards a low-carbon blue economy

There are numerous policies, strategies and initiatives supported by multilateral, bilateral and private sector actors working to transition into a low-carbon blue economy around the world. Some are already being implemented while others are just in the formative stages. Key benefits from optimization are listed in Table 2 below.

Emerging trends

Two of the most significant emerging factors in the low carbon blue economy are the dramatic increase in climate related finance being directed toward the blue economy, and the emergence of innovative approaches to climate change mitigation and adaptation.

Climate Finance in the Blue Economy

Building on the framework put forward by the World Bank work on Mobilizing Private Finance for Nature,[194] the blue economy financing landscape can be analysed through the perspective of two dimensions: scaling up 'financing blue' and 'blueing finance'.

Financing blue refers to the investment into existing coastal and marine sectors to decarbonise and reduce carbon emissions; for example shipping, ports, and fisheries around the world are receiving significant investment in this regard and will continue to do so in coming years. Conversely, blueing finance moves beyond 'business as usual' investment and aligns economic development opportunities with ocean health to foster low-carbon, resource-efficient growth that creates jobs and reduces poverty. This includes investing into innovative projects that provide (and monetise) ecosystem services such as climate change mitigation and adaptation, water quality, and biodiversity benefits. This type of finance is emerging, but characterized by relatively small investment into projects on an ad hoc basis rather than the sectoral investment seen in the 'financing blue' examples above. These type of projects will often receive a less certain or lower financial return but have the potential to provide very high environmental (and often social) impacts.

Blue Carbon Markets

Probably the most comprehensive and consistent examples of investment into ecosystem services (i.e. 'financing blue') are 'blue carbon' projects. Blue carbon is a promising element of broader climate mitigation strategies. The degradation of coastal ecosystems releases significant amounts of CO_2, therefore, conservation and restoration of these ecosystems contribute to the avoidance of carbon loss to the atmosphere. Blue carbon projects include protection and/or restoration of mangroves, coastal estuaries and wetlands, seagrass restoration, and seaweed based projects, as discussed in section 4 of this report. Investment in blue carbon offset projects can go beyond the carbon credits they generate. Depending on the project type, blue carbon projects have co-benefits of increased resilience of coastal areas and communities and often have measurable biodiversity and water quality co-benefits.

193 Vierros, M. (2021) Promotion and Strengthening of Sustainable Ocean-based Economies. Division for Sustainable Development Goals Department of Economic and Social Affairs United Nations, 2021.

194 https://thedocs.worldbank.org/en/doc/916781601304630850-0120022020/original/FinanceforNature28Sepwebversion.pdf

Needs for the Future

Blue Climate Finance

Although climate finance in the blue economy has increased significantly in recent years, much more will be required in the future. This is particularly important in the 'financing blue' realm, as the actual investment into innovative climate and nature-based solutions has not yet reached its potential. Reasons for this include investor reluctance to take risks on projects with uncertain cashflow (e.g. payment for mangrove or coral reef enhancement for climate mitigation outcomes), or where the investment is in the commons and investors are unable to have investments backed by physical assets with clear ownership. Globally there need to be efforts made to assist both investors (public, private, multi-lateral, philanthropic) and project developers to ensure that finance is deployed into projects, and that projects are scalable, replicable, and deliver clear, measurable climate and environmental impacts.

Blue Carbon Markets

There needs to be an increase in the scale and number of blue carbon projects globally, and this requires development and adoption of consistent methodologies, verification and certification of projects, and transparent reporting of carbon sequestration (and other impacts). Consistency and transparency will lead to replicability and scaling in different jurisdictions around the world, which will ultimately prove to be an essential component in climate related blue finance.

6.2 Examples of work on a sustainable blue economy

There are many practical examples of sustainable blue economy developments from around the world. This section provides a selection of examples that incorporate a variety of sectors.

United States of America: In January 2021, NOAA released its **Blue Economy Strategic Plan for 2021-2025**, laying out a roadmap for new ways to advance

Table 2. Optimizing a low-carbon Blue Economy from the Oceans

Ocean-based options to mitigate climate change and transition towards a Blue Economy	Areas of ocean-based climate action to mitigate Green House Gas (GHG) emissions	Benefits
Reduce global greenhouse gas (GHG) emissions by nearly 4 billion tons of carbon dioxide per annum in 2030 and by more than 11 billion tons per annum in 2050	-Ocean-based transport -Coastal and marine ecosystems -Ocean-based food system (wild capture fisheries, aquaculture, and shifting human diets towards food from the sea) -Carbon storage in seagrass beds, mangroves, seaweed and on the seabed -Ocean-based renewable energy production with the expansion of floating wind and solar facilities	Reduce dependency on fossil fuels, provide electricity for coastal communities, create jobs, generate revenue, sustainable seafood trade
Reduce the "emissions gap" (the difference between emissions expected if current trends and policies continue and emissions consistent with limiting global temperature increase) by up to 21 percent on a 1.5°C pathway, and by about 25 percent on a 2.0°C pathway, by 2050.		Improve air quality and human health
Reduce wider impacts on environment and social well-being – protection and restoration of mangroves, seagrass/seaweed beds, salt marshes for carbon mitigation		Support livelihoods if implementation addresses trade-offs with sustainable development dimensions appropriately
Phase out fossil fuels	Invest in wind, solar and tidal energy capture	Increased revenue
Create sustainable food systems		- Sustainable seafoods - Trade and export - Jobs, revenue

America's Blue Economy and enhance the global ocean economy. The Plan focuses on five sectors: marine transportation, ocean exploration, seafood competitiveness, tourism and recreation, and coastal resilience. Implementation of the plan will be through leveraging public-private partnerships and harnessing emerging technologies. In 2017, the ocean economy, which includes six economic sectors that depend on the ocean and Great Lakes, contributed $307 billion to the U.S. GDP and supported 3.3 million jobs. Among the priorities included in the plan are to: 1) promote U.S. Fishing & Seafood; 2) develop an American seafood campaign, advance ecosystem-based fisheries management; 3) combat IUU fishing; 4) grow domestic aquaculture; develop aquaculture opportunity areas; 5) expand and designate new National Marine Sanctuaries; 6) improve ocean health; 7) restore and protect coral reefs; 8) implement the National Marine Debris Strategy; and 9) understand and communicate economic value.

European Union (EU): In 2017, the EU issued the **Blue Growth Strategy Toward More Sustainable Growth and Jobs in the Blue Economy** report to promote: 1) growth in blue energy, aquaculture, coastal and maritime tourism, blue biotechnology, and seabed mineral resources; 2) generate marine data, spatial planning and maritime surveillance to facilitate growth in the blue economy; 3) adopt a partnership approach; 4) boost investment; and 5) make blue growth strategy fit future challenge. **The European Green Deal (2021)** is expected to transform the EU into a modern, resource-efficient and competitive economy, ensuring no net emissions of greenhouse gases by 2050; and economic growth decoupled from resource use. The Green Deal is expected to provide the impetus to implement the recommendations in the Blue Growth Strategy.

African Union (AU): The Blue Economy is a pillar of Africa's continental strategy: "Agenda 2063: The Africa We Want" and defines Blue Economy as *"constituted by all economic activities that emanate from Africa's oceans, seas / sea beds, lakes, rivers. Example of blue economy activities include: fishing, marine/ lake transport/ shipping, seabed mining, marine tourism, generation of tidal energy etc.".*

The African Union's (AU) Agenda 2063 sees the marine economy as a major contributor to growth, and Africa's Integrated Maritime Strategy 2050 (AIMS 2050) recognises the vast wealth creation potential of Africa's oceans, lakes and rivers. Adopted in 2014, AIMS 2050 represents an important step towards securing Africa's maritime interests and was conceived as a tool to address Africa's maritime challenges for sustainable development and competitiveness. It aims to foster more wealth creation from Africa's oceans, seas and inland water ways by developing a thriving maritime economy and realizing the full potential of sea-based activities in an environmentally sustainable manner. Some blue economy sectors and components (conservation, research, education and governance) are outlined in the AIMS but they are largely limited to the maritime and marine areas. Extractive mineral, oil and gas, innovative financing mechanisms were not considered in the AIMS 2050 as well as the issue of ecosystem services such as blue carbon and their uses for climate change mitigation and adaptation that is currently a top priority of the AU.

To boost the implementation of the 2050 AIM Strategy in conformity with International Maritime Law. The AU developed the African Charter on Maritime Security and Safety and development in Africa (Lomé Charter). The Lomé Charter refers to the security and safety of the Blue Economy and aims at preventing and curbing national and transnational crime. It also covers issues such as the Illegal, Unreported, and Unregulated (IUU) fishing, prevention of pollution at sea and other unlawful acts at sea, and all measures for the sustainable exploitation of marine resources and optimisation of the development opportunities of maritime sectors. The Lomé Charter also aims to protect the maritime environment in coastal and island states, as well as strengthen cooperation in the field. A full chapter of the Lomé Charter is dedicated to the development of a Blue Economy for Africa and other sections cover climate change and environmental protection. The coherence between the Lomé Charter and the 2050 AIM Strategy indicates strategic commitment on the part of governments to combating the numerous threats against Africa's Blue Economy.

Recognising the growing importance of the opportunities inherent in Blue Economy development, African leaders at the Nairobi Sustainable Blue Economy Conference in 2018, directed the AU to develop a blue print of Africa's Blue Economy Strategy to guide sustainable development and utilization of oceanic, fisheries and aquaculture resources in Africa. In 2019, the African Union Commission embarked on a process to develop the continental Blue Economy Strategy that focused on five thematic focus areas and launched the Strategy in 2020. Among a diverse set of drivers recognised as shaping the development of Africa's Blue Economy, climate related drivers include low carbon economies, climate resilience, adaptation, mitigation measures and the need for reflecting NDCs as essential components of the Blue Economy to create economic and livelihood opportunities in carbon capture and storage; as well as the demand for sustainable blue energy for addressing the ever-increasing energy demand.

To support the implementation of the AU Continental Blue Economy Strategy, the AUDA-NEPAD developed a Sustainable Blue Economy Programme that prioritises the pursuit of fundamental transformations in the capacity and systems to expand productivity, strengthen regional value chains and accelerate the generation of national wealth while creating jobs. African Blue Economy development is furthermore receiving dedicated attention by several AU Member States and Regional Economic Communities (RECs). Some RECs, such as IGAD and SADC, are presently, alongside other organizations such as the Indian Ocean Commission and IORA (Indian Ocean Rim Association), developing their own Blue Economy strategy. African SIDS are also engaged, with the SAMOA Pathway, in the process of development of their ocean-based economies.

World Bank (WB) Climate Investment Funds (CIF)[195]: CIF is an $8 Billion multi-donor trust fund that aims to accelerate climate action by empowering transformation into clean technology, energy access, and climate resilience in client countries. CIF is comprised of four funds: The Clean Technology Fund (CTF), Forest Investment Program (FIP); Scaling up Renewable Energy in low-income countries Program (SREP) and the Pilot Program for Climate Resilience (PPCR). CIFs provide support for **climate-smart development planning and action** in 72 developing and middle-income countries worldwide. Through its private sector arm, the **International Finance Corporation (IFC)**, the World Bank (WB) group is responding to the demand for mobilizing private investment and helping open low-carbon markets, where they do not exist.

Asian Development Bank (ADB): ADB issued its first ever **dual-tranche Blue Bonds** denominated in Australian and New Zealand dollars that will finance ocean-related projects in Asia and the Pacific. The Blue Bonds are part of ADB's **Action Plan for Healthy Oceans and Sustainable Blue Economies** launched in 2019, which aims to catalyze sustainable investments in Asia and the Pacific by committing to invest and provide technical assistance of at least $5 billion by 2024. The bonds were issued under ADB's expanded Green and Blue Bond Framework, which the Bank notes is a new milestone for sustainable ocean finance, reflecting the need for long-term support. It sets a new standard for blue financing in the market that can be replicated. ADB's blue bonds are replicable, scalable, and aim to grow the ocean economy across Asia and the Pacific. The proceeds will finance projects that enhance ocean health through ecosystem restoration, natural resource management, sustainable fisheries and aquaculture, reduction of coastal pollution, circular economy, marine renewable energy, and green ports and shipping. At the same time, these investments will support sustainable economic growth and jobs for the future.

African Development Fund (AfDB): The AfDB's Climate **Change and Green Growth Department (PECG)** supports member countries, to fulfil obligations related to the Paris Agreement and transform these economies into circular economies. The support will include: 1) fostering long-term climate action, 2) explore options to enhance low carbon and climate resilience growth on a long-term trajectory; 3) mobilize finance; 4) capacity building, technology development and transfer.

China: China is the world's largest producer of wind and solar energy. By 2030, the government expects that one-fifth of the country's electricity consumption will come from non-fossil fuel sources, and 40 percent of the world's growth in solar and wind energy in the next five years will come from China. Renewable energy deployment is also a part of a larger effort within China towards lower pollution levels, lower fossil fuel use, climate change mitigation, and improving energy efficiency.

India: In the State of **Madhya Pradesh,** the world's largest **floating solar project** will begin operations in 2022-23, with a 600MW capacity. The floating panels will cover approximately 2000ht of water in the **Narmada River.** According to the government, the project will require an investment of $410m (INR30bn). The **State of Gujarat** has commissioned India's first **Tidal Energy Plant** in the **Gulf of Kutch** to produce energy from the ocean tides. Gujarat state government and its partner **Atlantis Resource Corporation** expect the tidal energy generation from the Gulf of Kutch to be about 300 MW. According to the estimates of the Indian government, the country has a potential of 8,000 MW of tidal energy. This includes about 7,000 MW in the **Gulf of Cambay** in Gujarat, 1,200 MW in the Gulf of Kutch and 100 MW in the **Gangetic delta** in the **Sunderbans region of West Bengal.**

Morocco: The WB is supporting the world's largest concentrated solar power complex in Morocco. Generating 580 megawatts of clean energy, expected to

195 The Climate Investment Funds (CIF) is an $8 billion multi-donor trust fund that seeks to accelerate climate action by empowering transformations in clean technology, energy access, climate resilience, and sustainable forests in developing and middle-income countries. CIF is comprised of four funds: The Clean Technology Fund (CTF); the Forest Investment Program (FIP); the Scaling up Renewable Energy in low-income countries Program (SREP); and the Pilot Program for Climate Resilience (PPCR). CIF works with multilateral development banks (MDB) as implementing agencies; IFC is one of five MDBs that can access CIF funds to implement projects to support climate resilience and adaptation projects, meet the need for critical climate interventions around the world.

produce clean power for 1.1 million Moroccans. The government's Blue Economy strategy aims to develop the fisheries and aquaculture sectors, sustainable marine energy and sustainable ocean and coastal tourism.

Seychelles: In 2018, the Seychelles launched the world's first sovereign blue bond to finance sustainable fishing practices and marine protection. The blue bond benefits from two instruments: partial guarantee by the World Bank (IBRD) of $5 million, and a grant of $5 million from GEF, which partially subsidized the bond's interest payments from 5.5 to 2.8 percent. The bond was privately placed with three private investors: **Nuveen, Prudential and Calvert Impact Capital.** The majority of the transaction costs for the bond were covered by the **Rockefeller Foundation. Standard Chartered Bank and Bank of New York Mellon** assisted in the process and payments. Proceeds finance the sustainable transition include small-scale fisheries, rebuilding of fish stocks and control of the harvest of marine projects. Being the first of its kind, the **Seychelles' Blue Bond** is a replicable model, especially for other SIDS, that are seeking to increase the adaptability and resilience of local communities and protect marine ecosystems.

6.3 Summary of achievements and future needs

The blue economy has been the focus of a great deal of attention in recent years, and has catalysed new plans and policies, with associated actions, in many countries. The blue economy is also one major avenue through which the SDGs, including in particular SDG 14, could be more closely linked with climate action. However, for this to happen, it is important to develop a common understanding about what activities and sectors could be part of a sustainable low-carbon blue economy, and under what conditions, as well as what an environmentally and socially sustainable blue economy would look like. This would likely include the future development of common guidance or guidelines for blue economy transitions.

Some other priority actions for the future include the following:

- **Promote new financial instruments such as Blue Bonds:** The funding gap to support healthy oceans is getting wider every year and the scale of the problem requires a leap from small transactions to transformative market deals. Innovative financial products like blue bonds diversify and expand the investor base,

Box 3. New approach to a sustainable blue economy in the European Union

In May 2021, the European Commission proposed a new approach for a sustainable blue economy in the EU for the industries and sectors related to oceans, seas and coasts. It sets out a detailed agenda for the blue economy to:

- **Achieve the objectives of climate neutrality and zero pollution** notably by developing offshore renewable energy, by decarbonising maritime transport and by greening ports.
- **Switch to a circular economy and reduce pollution –** including through renewed standards for fishing gear design, for ship recycling, and for decommissioning of offshore platforms and action to reduce plastics and microplastics pollution.
- **Preserve biodiversity and invest in nature -** protecting 30% of the EU's sea area will reverse biodiversity loss, increase fish stocks, contribute to climate mitigation and resilience, and generate significant financial and social benefits. Environmental impacts of fishing on marine habitats will be further minimised.
- **upport climate adaptation and coastal resilience –** adaptation activities, such as developing green infrastructure in coastal areas and protecting coastlines from the risk of erosion and flooding will help preserve biodiversity and landscapes, while benefitting tourism and the coastal economy.
- **Ensure sustainable food production -** sustainable production of and new marketing standards for seafood, use of algae and seagrass, stronger fisheries control as well as research and innovation in cell-based seafood will help to preserve Europe's seas. With the EU sustainable aquaculture strategic guidelines now also adopted, the Commission has also committed to growing sustainable aquaculture in the EU.
- **Improve management of space at sea –** the new Blue Forum for users of the sea to coordinate a dialogue between offshore operators, stakeholders and scientists engaged in fisheries, aquaculture, shipping, tourism, renewable energy and other activities will stimulate cooperative exchange for the sustainable use of marine environment. A report on the implementation of the EU Directive on Maritime Spatial Planning will be issued in 2022, following the adoption of national maritime spatial plans in March 2021.

The Commission will also continue creating the conditions for a sustainable blue economy internationally following the international ocean governance agenda.

thereby increasing the amount of capital that can be invested in ocean health. The challenge with Blue Bonds as the experience of the Seychelles shows is that a range of actors are needed to make it a success. They include the funders, guarantors, large private foundations, corporations and a facilitator – in this case The Nature Conservancy – as part of their audacious plan to increase the world's marine protected areas by up to 15% within a decade. The role of the facilitator is instrumental as is the commitment of the government. In the case of the Seychelles the government's interest was largely the ability the Blue Bonds provided to pay back sovereign debt with the money raised from the bonds, which in turn led to enhanced economic growth, environmental sustainability and social inclusion – a win-win for all. The transactions costs were high, and Seychelles was fortunate to get these costs absorbed by the Rockefeller Foundation and the two banks mentioned above. It will be challenging for other developing nations (including the SIDS) to either absorb such costs or mobilize others to absorb them.

- **Technical assistance to support National governments** which are struggling to understand best practice in transitioning to a low-carbon Blue Economy; understand their obligations for NDCs, reduce fossil fuel dependency, promote clean energy markets, and create equitable conditions for the labor market to adjust and thrive in a net-zero world. They need access to the different financial instruments floated by multilateral and private sector entities. Such access may need to be facilitated by third party intervention to ensure that the poorer countries are not left behind in this transformation.
- **Greater engagement of the Private Sector** - Greater volumes of finance are needed not only from multilateral and bilateral sources but also the private sector to disaggregate electricity production: hydro, geothermal, wind, solar, biomass, nuclear sources and to optimize ocean-based energy including solar, wind and tidal.
- **Greater financial support and commitment** are needed especially from local governments and the private sector to **recycle, re-use and recover 100% of plastic packaging by 2040,** which is critical to address the disaster affecting the world's oceans through plastic pollution. Achieving this goal requires better packaging design, effective ways for people to collect used packaging and new technologies to reuse, recycle or recover packaging
- **Set up *"mini-grids"*** powered by solar photovoltaic panels and solar platforms such as being set up in coastal states in India and China to store solar electricity generated during the day. However, developing countries need financing to raise awareness and build capacity in communities to use equipment that consume less electricity and help generate revenues. Partnerships with the private sector as well as south-south cooperation are both critical to adopt a market-driven approach to enhance ownership of technology and drive long-term adoption of new technologies.

7. POPULATION DISPLACEMENT

7.1 Status, current work and future projections

This section provides the latest available statistics on population displacement and future projections due to climate change, with a particular focus on coastal areas and islands. Based on a review of recent reports on the topic, the section concludes with recommendations for the future.

Current statistics and projections on population displacement and migration

In 2020, it is estimated that 30.7 million people were internally displaced by disasters worldwide.[196] Of those, 14 million were displaced in the context of floods and 14.6 million in the context of storms.[197] Although not included under these figures, many more people are displaced in the context of slow-onset processes, including sea level rise, salinization, ocean acidification, loss of biodiversity and increasing temperatures.198 However, owing to monitoring and data-related challenges, the number of people displaced in the context of slow-onset processes is currently unknown.

Human mobility[199] in the context of disasters, climate change and environmental degradation is multi-causal, and environmental drivers such as sea-level rise or ocean acidification cannot be disentangled from social, political, economic, and demographic factors.[200] This is one of the reasons that make forecasting human mobility problematic. However, in the recent report *Groundswell Part 2: Acting on Internal Climate Migration*[201] the World Bank "specifically examined how slow-onset climate change impacts on water availability and crop productivity, and sea-level rise augmented by storm surge, could affect future internal migration". It finds that because of its impacts on people's livelihoods and loss of livability in highly exposed locations (beyond coastal areas), climate change, an increasingly potent driver of migration, could force 216 million people across six world regions to move within their countries by 2050. Sub-Saharan Africa could see as many as 86 million internal climate migrants; East Asia and the Pacific, 49 million; South Asia, 40 million; North Africa, 19 million; Latin America, 17 million; and Eastern Europe and Central Asia, 5 million.

The report also notes that while hotspots of internal climate migration could emerge as early as 2030 and continue to spread and intensify, immediate and concerted action to reduce global emissions, and support green, inclusive, and resilient development, could reduce the scale of climate migration by as much as 80 percent. Despite some ongoing knowledge and data gaps, evidence of the potential impacts of climate change on human mobility has grown considerably, and the need for significant action is now widely recognized.[202]

The 2020 World Migration Report cites different perspectives on environmental change and migration, originating from the view that human mobility, including migration, may be approached as a security issue. As such, it is an issue of protection, with adaptation and the management of risks associated with environmental change as key response measures. Human mobility refers to a broad spectrum covering migration, displacement and planned relocation, as well as "environmental migrants", including in relation to extreme events and other environmental stressors. The report further notes that while advances have been made in climate change research there are persistent data and knowledge gaps, including cost factors. Although increasingly reliable figures for the number of new internal displacements related to rapid onset environmental disruptions are produced annually, there are difficulties in obtaining reliable migration numbers when movements are less forced; for example, for people moving in anticipation of or response to slow-onset processes such as desertification or sea-level rise.[203]

196 https://www.internal-displacement.org/sites/default/files/publications/documents/grid2021_idmc.pdf
197 Ibid
198 Ibid
199 **Definitions: Human mobility:** A generic term covering all the different forms of movements of persons. Note: The term human mobility in the context of the climate negotiation reflects a wider range of movements of persons than the term migration. The term is usually understood as also encompassing tourists that are generally considered as not engaging in migration. For example, the international organizations member of the Advisory Group on Climate Change and Human Mobility are using the term human mobility to refer to the broad range of types of movements that can take place in the context of climate change. Source: Advisory Group on Climate Change and Human Mobility, Human Mobility in the Context of Climate Change UNFCCC - Paris COP21 (2015). **Environmental migrant:** A person or group(s) of persons who, predominantly for reasons of sudden or progressive changes in the environment that adversely affect their lives or living conditions, are forced to leave their places of habitual residence, or choose to do so, either temporarily or permanently, and who move within or outside their country of origin or habitual residence. There is no international agreement on a term to be used to describe persons or groups of persons that move for environment related reasons. This definition of environmental migrant is not meant to create any new legal categories. It is a working definition aimed at describing all the various situations in which people move in the context of environmental factors. Sources: Council of the International Organization for Migration (IOM), Discussion Note: Migration and the Environment (November 2007) MC/INF/288; IOM, International Dialogue on Migration (no. 18) Climate Change, Environmental Degradation and Migration (2012); IOM, Outlook on Migration, Environment and Climate Change (2014). **Disaster displacement:** The movement of persons who have been forced or obliged to leave their homes or places of habitual residence as a result of a disaster or in order to avoid the impact of an immediate and foreseeable natural hazard (…) (Source: Adapted from The Nansen Initiative, Agenda for the Protection of Cross-Border Displaced Persons in the Context of Disasters and Climate Change (Vol. 1, December 2015) p. 16.). Disaster displacement may take the form of spontaneous flight, an evacuation ordered or enforced by authorities or an involuntary planned relocation process. Such displacement can occur within a country (internal displacement), or across international borders (cross-border disaster displacement) (ibid.). **Planned relocation:** planned relocation in the context of disasters or environmental degradation, including when due to the effects of climate change, is a planned process in which persons or groups of persons move or are assisted to move away from their homes or place of temporary residence, are settled in a new location, and provided with the conditions for rebuilding their lives. Source: Adapted from The Brookings Institution, Georgetown University Institute for the Study of International Migration and United Nations High Commissioner for Refugees, Guidance on Protecting People From Disasters and Environmental Change Through Planned Relocation, (Brookings, 2015) p. 5., Weerashinghe & Bower 2021
200 https://environmentalmigration.iom.int/atlas-environmental-migration

201 https://openknowledge.worldbank.org/handle/10986/36248
202 Celia McMichael et al 2020 Environ. Res. Lett. in press https://doi.org/10.1088/1748-9326/abb398
203 IOM 2020.

According to the Global Climate Risk Index 2020 report, which analyses to what extent countries and regions have been affected by impacts of weather-related loss events (storms, floods, heatwaves etc.), the countries and territories affected most in 2018 were Japan, the Philippines and Germany. For the period from 1999 to 2018 Puerto Rico, Myanmar and Haiti ranked highest. The same report argues the need to debate the lack of climate finance to address loss and damage at UNFCCC COPs. In this context, the implementation of measures to adapt to climate change must be strengthened, including responses that address the need for people to move.

Coastal areas and islands

Coastal areas and islands are severely exposed to climate hazards. The increased frequency and intensity of extreme rainfall events under climate change scenarios raises concerns related to the capacity of coastal communities to cope with hazards. 2020 brought the most active hurricane season on record, with 13 hurricanes affecting 17 countries and territories causing around 2.8 million new displacements. One of the main factors aggravating the record-breaking season was the change in Pacific Ocean surface temperatures caused by a moderate to strong manifestation of La Niña.204

In the Americas, hurricanes Laura, Eta and Iota caused 2.7 million new displacements in 2020 across 14 countries, mostly in coastal areas.[205] Historical analyses have shed light on a positive correlation between hurricane impacts and migration from Central America.[206] Disasters are likely to be increasingly compounded by sea level rise and coastal erosion. Coastal erosion affects tourism and agriculture and harms income opportunities for coastal communities. In Panama, the Guna Yala community, partially settled on small islands of the Caribbean, has been at the center of a public debate regarding the potential use of planned relocation solutions to reduce exposure to sea level rise.[207] In Peru, a recent study by IOM and the Potsdam Institute for Climate Impact Research (PIK) sheds lights on the displacement outcomes of the 2017 El Niño in coastal communities but also the use of migration as a coping mechanism for fishers adapting to the climate-related variability of halieutic resources.[208] In recognition of the exacerbating impacts by climate change, U.S. President Biden signed an executive order to "put the climate crisis at the center of foreign policy and national security," shortly after taking office in January 2021, highlighting the importance of an international response to migration issues, among others.

In West Africa, coastal communities are facing sea-level rise, lands and river salinization, food insecurity and heavy loss of livelihoods. The project "Implementation of Global Policies on Environmental Migration and Disaster-Related Displacement in West Africa",[209] implemented by the IOM and funded by the Government of France, is supporting two communities in adapting to and mitigating these adverse effects of climate change in Casamance, Southern Senegal. Through this intervention, IOM and

204 Ibid
205 Ibid
206 https://publications.iom.int/books/la-movilidad-humana-derivada-de-desastres-y-el-cambio-climatico-en-centroamerica

207 http://displacementsolutions.org/wp-content/uploads/2017/01/Gunayala-Planned-Relocation-Jan-2017.pdf
208 https://environmentalmigration.iom.int/assessing-evidence-climate-change-and-migration-peru
209 https://environmentalmigration.iom.int/projects/implementing-global-policies-environmental-migration-and-disaster-displacement-west-africa

its partners, including the Regional Development Agency (ARD) and the Regional Division of the Environment and Classified Establishments (DREEC), were able to collect the perception of communities on the complex challenges they are facing. Beside salinization of cultivation areas, loss of beaches, mangroves, housing and economic infrastructure, communities have also named the gradual abandonment of dominant economic activities such as seaside tourism and fish trade. In addition, as the space for docking the pirogues is shrinking under the pressure of sea-level rise, tensions are rising-up between communities of fishermen and the tourism sector. As a consequence, the mobility of young people through rural exodus and irregular emigration is perceived as an important coping strategy.

Asia and the Pacific continued to be the region most affected by disaster displacement. Some 12.1 million people across the region were displaced by disasters in 2020, the highest number since 2016.[210] Early results of a soon-to-be-released assessment commissioned by IOM highlight that an alarming rise of sea levels in Timor-Leste is driving people away from the coast and their established livelihoods, which is mainly derived from fishing. The analysis points to a length of some 306.63 km of coastline being affected to varying degrees in the next 5 years. The Boe Declaration on Regional Security adopted at the Pacific Islands Forum in 2018 stated that 'Climate change remains the single greatest threat to the livelihood, security and wellbeing of the peoples of the Pacific'. At the policy level, development of policy processes in the region includes the establishment of a joint-working group (JWG) on climate mobility, convened at the request of participating Pacific governments, to work with the Pacific Islands Forum (PIF) Secretariat. Established in the context of the Pacific Climate Change Migration and Human Security (PCCMHS) programme,[211] the JWG aims to identify a clear process and modalities for the development of a regional framework to address the key issues emerging in the context of climate mobility. To support with the drafting of the regional framework, IOM has facilitated national consultations in Nauru, Fiji, Tonga, Tuvalu, Vanuatu, Papua New Guinea and Kiribati with preparations continuing in FSM, Solomon Islands, Cook Islands, Samoa, RMI and Niue.

Human mobility in the context of disasters, climate change and environmental degradation is multi-causal, and environmental drivers such as sea-level rise or ocean acidification cannot be disentangled from social, political, economic, and demographic factors.[212]

210 IDMC 2021, above n 137.
211 https://environmentalmigration.iom.int/projects/pccmhs
212 https://environmentalmigration.iom.int/atlas-environmental-migration

This is one of the reasons that make forecasting human mobility problematic. However, in the recent report *Groundswell Part 2: Acting on Internal Climate Migration,*[213] the World Bank "specifically examined how slow-onset climate change impacts on water availability and crop productivity, and sea-level rise augmented by storm surge, could affect future internal migration". It estimates that the number of internal climate migrants by 2050 could exceed 216 million across six regions: Sub-Saharan Africa, South Asia, Latin America, East Asia and the Pacific, North Africa, and Eastern Europe and Central Asia. The report highlights the potential to reduce these figures by as much as 80% if measures are taken to sharply reduce global greenhouse gas emissions and implement appropriate adaptation measures. Despite some ongoing knowledge and data gaps, evidence of the potential impacts of climate change on human mobility has grown considerably, and the need for significant action is now widely recognized.[214]

Recent findings and emerging issues

Displacement is one of the most common and immediate impacts of any disaster, and in the specific context of disasters and climate change, displacement has been described as one of the greatest humanitarian challenges of the 21st century. The recently published IPCC AR6 highlights with confidence the human-induced impact on life support systems including air, water, and ice. AR6 indicates that human contribution to climate change has caused weather and climate extremes. They include notably the hot extremes such as land and marine heatwaves, which pose danger to lives and livelihoods for people in coastal areas. High impact category 3-5 cyclones have increased in the Pacific, putting coastal communities at greater risk of displacement and migration. While individual hazards often have enormous impacts on communities, the observed increased occurrence of two extreme hazards at the same time, also known as compounding hazards, is likely to erode the adaptive capacity of many communities including those having fairly adapted to single hazards.

This increase in the frequency and intensity of extreme weather, water and climate extremes, coupled with the compounding effects of other shocks, can significantly amplify the complex drivers of displacement and migration. Often there is an overlap of conflict, environmental degradation and climate crisis impacts, which exacerbate already constrained livelihoods and drive human mobility.

213 https://openknowledge.worldbank.org/handle/10986/36248
214 Celia McMichael et al 2020 Environ. Res. Lett. in press https://doi.org/10.1088/1748-9326/abb398

In June 2021, a special issue of *Current Opinion in Environmental Sustainability* was published responding to an invitation from UNFCCC Executive Committee of the Warsaw International Mechanism (WIM Excom) to bring together a collection of articles on environmental sustainability in relation to slow onset events. Among series of papers, five journal papers focused on migration, displacement, and planned relocation. Those papers examined: the state of knowledge on human mobility related to climate change slow-onset events particularly in developing countries; analyzed relevant global experience of planned relocation and pointed out the lack of funding for pre-emptive planned relocation; and also looked into specific regional and country experiences of relocation and displacement in Fiji, Latin America and Vanuatu respectively.

Conflict

People, systems and institutions already coping with conflict tend to have a limited capacity to adapt. The 2020 ICRC report "When Rain Turns to Dust" concludes that adapting to a changing climate can require major social, cultural or economic transformation, but ambitious, concerted and long-term efforts tend to be limited in times of war, not only because authorities are weakened, but because they tend to concentrate on restoring national security, and revitalizing the economy and infrastructure. Without institutional support, people and communities trying to cope may change or diversify their livelihoods, adapt their way of life, or move away from their homes. Although mobility tends not to be people's primary means of adaptation, in the absence of viable options many end up moving, usually within their own country. Lack of institutional support can make such moves permanent – and leave the poorest and most vulnerable trapped in place. Some move preventively as they see their situation deteriorating, others react to a safety threat caused by conflict or extreme weather, or a combination of both, and often end up in poor urban areas where they continue to be exposed to hazards and may again be forced to move.

Environmental degradation

Increasingly frequent and unpredictable natural events, including droughts, floods, earthquakes, landslides, wildfires, cyclones and coastal erosion threaten people's livelihoods and force many to leave their homes. Especially in places affected by decades of social and environmental fragility, conflict often directly harms the ecosystems on which people rely for their survival.[215]

Climate crisis

"The humanitarian sector is at the intersection of two worsening global trends: a warming world and increasing levels of disaster displacement. At this intersection lies the certainty that the long-forecasted climate change crisis is already here and is, today, compromising the lives, safety and livelihoods of millions of people around the world."- IFRC 2021

Policy responses and major initiatives

Global efforts to address the links between migration and climate change have advanced considerably over the past decade. The UNFCCC first recognized the importance of human mobility with the adoption of the 2010 Cancun Adaptation Framework. When the 2015 Paris Agreement was adopted during the COP21, climate migrants were finally rendered visible within the wider international policy arena. More recently, the Global Compact for Safe, Orderly and Regular Migration – the first intergovernmentally agreed framework to address migration in all its dimensions – contains multiple references to environmental migration, articulating a wide and comprehensive understanding of the challenges linked to the environment-migration nexus. Other multilateral agreements – such as the small island developing States focused SAMOA Pathway, which deals with key environmental issues such as oceans, ecosystems or water, the United Nations Convention to Combat Desertification (UNCCD) and the Sendai Framework for Disaster Risk Reduction – are also incorporating migration issues.

Within the UN system, several agencies and intergovernmental bodies have been advancing the issue as well. Since 2007 for example, IOM has reported on its work on migration, environment and climate change within its governing bodies, including at its Council and the Standing Committee on Programmes and Finances. In 2021, the International Dialogue on Migration - IOM's principal forum for migration policy dialogue - convened its 20th edition on the topic of migration, the environment and climate change. Other UN entities have similarly begun to integrate the topic in their work. These include:

- the United Nations Convention to Combat Desertification (UNCCD)
- the Sendai Framework for Disaster Risk Reduction
- the Human Rights Council (HRC)
- work under the Office of the High Commissioner for Human Rights (OHCHR)

215 ICRC 2021.

- the International Labour Organization (ILO)
- the United Nations Environment Assembly (UNEA)
- the United Nations High Commissioner for Refugees (UNHCR) Executive Committee.

Of particular note is the Platform on Disaster Displacement (PDD), a State-led initiative to address the protection gap for persons displaced across borders, and in particular to implement the Nansen Protection Agenda adopted by 108 countries in 2015. The PDD work plan is aimed at increasing adaptive capacity of all people who may move in relation to environmental stresses like disasters and climate change, and the PDD's recently updated strategy promotes managing displacement risks through moving "out of harm's way in a dignified manner, through the creation of pathways for safe, orderly and regular migration".

Strategic policy harmonization efforts are also underway in the humanitarian sector. The announcement at COP26 of signatories to The Climate and Environment Charter for Humanitarian Organizations[216] marks a milestone in galvanizing collective action in response to the climate and environmental crises, in particular for those who feel their impacts the most. The result of a broad consultative process with the support of an advisory committee bringing together humanitarian, climate and environment experts, hundreds of humanitarian professionals and organizations, including the Red Cross Red Crescent Movement, UN agencies, international NGOs, and local and national organizations consulted on the Charter.

The Charter includes seven high-level commitments to guide the sector's response to the climate and environmental crises. First among them "to support those who are the most at risk, taking into account the influence that individual characteristics, such as gender, age and disability, structural inequity, legal status, and situations such as poverty, marginalization, displacement, migration, public health emergencies or armed conflict, have on people's capacities and vulnerabilities."

A 2021 IFRC report on National Red Cross and Red Crescent Societies, disasters and displacement in a changing climate, positions localised humanitarian action at the epicentre of the climate crisis and points to the need for risk-informed approaches that address the hazard, exposure and vulnerability drivers of displacement in the context of basic human needs, human security and human dignity, in tailoring interventions to build community level climate resilience.

Iterative climate fragility and risk assessments of security policies and strategies are needed to reorient approaches towards building more comprehensive human security including lasting peace through resilient food systems, livelihoods and underlying environmental services. Current approaches do not consider climate-related risks adequately and can thus assume greater adaptive capacities without factoring in the risk of conflict. Including humanitarian actors in adaptation processes such as conducting regular national climate risk assessments can help inform security policies and strategies to better address the drivers of displacement.

Normative reporting on climate-related security risks is also needed to support meaningful international and regional cross-border cooperation. It is essential that donors and development partners supporting adaptive interventions receive up-to-date and independent assessments of the risks of climate fragility, and that these partner institutions are ready and willing to adapt their approaches based on up-to-date assessments. To meet this need, significant efforts will be required to improve data collection and analysis, as well as staff expertise on climate-related risks.

Addressing the displacement challenges linked to livelihood dependence on a healthy environment, including transhumance (seasonal movement of livestock between fixed summer and winter pastures), is an emerging frontier for research and programming, which requires understanding water and natural resources as regenerative systems that provide ecosystem services, with attention beyond the rapid drying up of rivers, e.g. to understand drivers that are linked to a changing climate, such as seasonality in the relationship between rainfall and groundwater, or the effects of increasing heat to the nutritional quality of crops and fodder.

7.2 Summary of achievements and future needs

The discussion above has highlighted the severe exposure of coastal areas and islands to climate

hazards, and the complexity of the often multiple reasons for population displacement and migration. While the available data is improving, the information about issues such as slow-onset processes is still incomplete. The discussion has also emphasized the need for international cooperation to increase the adaptive capacity of vulnerable people, and to manage human displacement with dignity in the face of a worsening climate crisis.

The following recommendations have been put forward:

216 https://www.climate-charter.org/

Policy guidance

Ahead of COP 26, IOM calls on the Parties to UNFCCC to consider the following:

1. Committing to the urgency of addressing human mobility linked to climate hazards in climate change policies, on the basis of the available climate and migration evidence, via integrated human rights-based, child-sensitive and gender-responsive approaches for migration management and climate change action, aiming at the full implementation of the Paris Agreement, the Global Compact for Migration, the Sendai Framework for Disaster Risk Reduction, and the 2030 Agenda for Sustainable Development.
2. Increasing support for climate change adaptation action, measures, and resources to avert and minimize displacement and strengthen people's resilience.
3. Enhancing the recognition of human mobility within adaptation and loss and damage, with action on both slow-onset processes and sudden-onset hazards, at local, national and regional levels, considering planning processes and integrated approaches to disaster risk reduction, preparedness and humanitarian assistance.
4. Strengthening support to the most vulnerable countries and people to climate change impacts and facilitating their access to significantly scaled up sustainable and predictable finance for adaptation and resilience, including addressing climate change-related human mobility.
5. Enhancing the inclusive mobilization of the whole society, associating public and private partners, civil society, women, youth, indigenous people, migrants, displaced persons and affected communities to decision-making processes related to climate change and migration.

For Parties to the UNFCCC

- Scale up commitments in NDCs to attain the long-term climate goals of the Paris Agreement.
- Focus more attention on supporting communities impacted right now by the existing impacts of climate emissions to date, not just the impacts of future emissions.
- Ensure that climate financing is mobilised to assist the most vulnerable developing countries to mitigate the current humanitarian impacts of emissions to date, including fragile States and States experiencing conflict.
- Scale-up the funding of local actors and communities as a core element of enhanced financing for climate change adaption; ensure such funding is streamlined with humanitarian, disaster risk reduction, and humanitarian and development funding streams.
- Prioritise the implementation of the recommendations of the Taskforce on Displacement of the Warsaw International Mechanism on Loss and Damage.
- Grand Bargain signatories should ensure concrete progress on the Grand Bargain 2.0 enabling priorities to promote local and national actor leadership in the delivery of humanitarian assistance.
- Ensure humanitarian assistance is climate smart through increased use of anticipatory action, including forecast-based financing at the local level to prevent extreme weather events from becoming disasters.
- Maximise synergies between humanitarian assistance, climate change adaptation, disaster risk reduction, and development projects and programmes.

For National Governments

Enhance disaster-risk governance by:

- Integrating displacement and other forms of human mobility into NAPs and other climate change adaptation planning processes to capture their opportunities as well as challenges.
- Reviewing existing laws and regulations against best practice standards in the IFRC Disaster Law Handbook and Checklists, and urgently begin drafting necessary changes to legislation.
- Promoting localisation through capacity strengthening and adequate resourcing of the most local level within governance structures and coordination with local civil society actors.
- Prioritising anticipatory action and early action, including forecast-based financing when required.

8. FINANCING ON THE OCEAN AND CLIMATE

This section focuses on financing related to the ocean and climate, based on the following Roadmap recommendations: *Adaptation and mitigation efforts in coastal and SIDS countries/communities should receive sufficient funding through: 1) directing a significant portion of the current climate funds to coastal and SIDS issues, and 2) developing supplementary financing to support adaptation and mitigation methods through innovative approaches and partnerships.*

The section provides a summary of current levels of finance, innovative sources of ocean financing, as well as success stories and future needs.

8.1 Financing on the ocean and climate

Finance for ocean and climate solutions is the result of multiple pathways, ranging from the funding of specific projects at the nexus of ocean and climate, such as direct funding of marine renewables investments or of coastal resilience through nature-based solutions such as blue carbon ecosystems. Other financing is more indirect, such as climate finance from the Green Climate Fund for terrestrial projects that still benefit the ocean, or ocean conservation finance that targets biodiversity and as a consequence also delivers climate mitigation and adaptation. As the recent "Our shared seas" report[217] notes: "in 2019, approximately USD 3.1 billion in funding was allocated to marine conservation globally from philanthropic, development aid, NGO discretionary funding, and private finance sources. Ocean-climate is an emerging and still small area of grantmaking. Funding levels for marine conservation from philanthropy and official development assistance (ODA) have been roughly comparable in size over the past decade.".

The overall level of such finance continues to show a vast gap between the needs identified by multiple studies218and the funding provided, in particular given the fact that the amount of subsidies and other incentives for activities that harm ocean health far exceeds the amount available for ocean finance solutions.[219]

Nonetheless significant progress has been made since UNFCCC COP21 not only in identifying financing needs, tools and opportunities, but also in describing the processes required to scale up ocean climate finance overall and to target it, in particular also to those most affected, such as SIDS. Conservation finance opportunities are increasingly identified[220] and we see strengthened ocean-climate finance action via the Green Climate Fund. The commitment to sustainable blue economy trajectories has helped countries to focus on ocean and nature-positive development. This is of particular relevance to coastal and island developing countries, including in Africa[221]. Knowledge and research initiatives such as the High-Level Panel for a Sustainable Ocean Economy and the Friends of Ocean Action have shown that investment in ocean solutions can help to deliver a significant contribution to address climate change.[222] In 2021 the Chair of SBSTA hosted the first ocean-climate finance dialogue and stated in the summary report.[223] "I encourage Parties to strengthen their ambition and financing for integrated ocean and climate action." Integrating blue finance effectively into the emerging green and climate finance architecture[224] is critical to delivering significant ocean climate finance commitments. The Multilateral development finance institutions and the GEF play a critical role in supporting blended finance solutions[225] for this trajectory and are rapidly developing standards and processes.

8.2 Innovative sources of ocean financing

Innovative sources of ocean financing range from new targeted funding mechanisms and dedicated intermediaries to the use of specific processes, including debt-for-nature swaps, blue bonds and public-private partnerships. Impact investors are playing a key role in identifying investment opportunities and working with local partners. These range from mangroves and seagrass protection and restoration to marine protected area management.

Specific financing initiatives, such as the Ocean Risk and Resilience Action Alliance (ORRAA), the Coalition for Private Investment in Conservation (CPIC), the Subnational Climate Fund and the IUCN Blue Natural Capital Finance Facility (BNCFF) are delivering critical support to facilitate such investments into concrete projects on the ground. MDB financing initiatives, such as the Asian Development

217 CEA Consulting (2021) A Decade of Ocean Funding: Landscape Trends 2010–2020. Our Shared Seas Report.

218 Deutz, A. et al. (2020). Financing Nature: Closing the global biodiversity finance gap, s.l.: The Paulson Institute, The Nature Conservancy, and the Cornell Atkinson Center for Sustainability;
Laffoley, D. et al. (2020) Eight urgent, fundamental and simultaneous steps needed to restore ocean health, Aquatic Conserv: Mar Freshw Ecosyst.
Sumaila, U.R., M. Walsh, K. Hoareau, et al. (2020) Ocean Finance: Financing the Transition to a Sustainable Ocean Economy. Washington, DC: World Resources Institute. www.oceanpanel.org.

219 Sumaila, U.R. et al (2021) Financing a sustainable ocean economy. Nature Comms https://www.nature.com/articles/s41467-021-23168-y.pdf

220 Baralon, J. et al. (2021) Conservation Finance 2021.An Unfolding Opportunity. CPIC Report

221 Thiele, T. (2021a) Innovative Finance for Africa's Blue Economy in Sparks, D. (ed) Blue Economy in sub-Saharan Africa. Taylor Routledge

222 Stuchtey, M. et al. (2020) Ocean Solutions That Benefit People, Nature and the Economy. oceanpanel.org

223 UNFCCC (2021) Ocean and climate change dialogue to consider how to strengthen adaptation and mitigation action. Informal summary report by the Chair of the Subsidiary Body for Scientific and Technological Advice.

224 Thiele, T. (2019) Adding "Blue" to International Climate Finance. In: From "Green" to "Blue Finance": Integrating the Ocean into the Global Climate, LSE Global Policy Lab 2019

225 Thiele, T., von Unger, M., Mohan, A. (2021b) MDB Engagement: Mainstreaming Blue Nature-based Solutions into Infrastructure Finance. . Report by Silvestrum Climate Associates.

Bank's Healthy Ocean Action Plan, the World Bank PROBLUE multi-donor trust fund and the European Investment Bank's Blue Sustainable Ocean Strategy can support such efforts, both through de-risking and through blended finance. They have also played a key role in launching the initial blue bonds, from the World Bank support for the Seychelles Blue Bond in 2019 to the new ADB Blue Bond.[226] Key to the success of these efforts as capital market products are robust impact assessment and monitoring frameworks,[227] so as to ensure that the promised outcomes can be appropriately validated.[228]

8.3 Success stories and future needs

We increasingly have the knowledge of what is involved in ocean finance,[229] the tools and mechanisms for implementation,[230] appropriate principles[231] and emerging approaches[232] and the specific project experience[233] to see what works and what does not. Encouragingly, countries as diverse as Kenya, Belize the Seychelles and others have now incorporated blue carbon solutions in their Updated Nationally Determined Contributions to the Paris Agreement, thus facilitating finance in this area. The 'blue economy' approach has helped to recognise the role that ocean and coastal ecosystems play in climate mitigation and in achieving sustainable development.

While finance flows for climate adaptation and mitigation have increased by 35% in recent years, they still fall short of what is needed, especially in developing countries. Much remains to be learned about how to unlock and enable private capital to help finance national and local adaptation priorities, and how to build the business case for adaptation.

De-risking finance and using innovation to mobilise investment is key to scale up the amount of finance required and to make sure that countries have continued access even during periods of financial dislocation, such as now during the COVID-19 pandemic.

What is still needed is a comprehensive ocean finance architecture that delivers adequate finance for coastal zones and the high seas alike and fully integrates ocean climate solutions.[234] The required investment taxonomy has to adequately value the ocean as blue natural capital. Climate and ocean risk need to be fully integrated, including at central bank disclosures level. Infrastructure finance in particular, given its scale, relevance to communities, and impact on nature, needs to be strongly redirected to fully integrate nature-based solutions for climate.[235] Blue carbon projects can provide an important contribution to the delivery of market- based approaches but also need to address the biodiversity, resilience and livelihoods aspects of coastal ecosystems. These are crucial to the long-term viability of projects and at the core of blue natural capital as an emerging asset class for long-term, biodiversity-positive investment.

Development of public-private partnerships and investment cases, together with sectoral and regional bodies, as well as multilateral finance institutions along a science-based roadmap to sustainable development together with a Policy on Natural Capital[236] should be explored. The upcoming UNFCCC COP26 has the opportunity to progress these key ocean finance components.[237]

226 ADB (2021a). Sovereign Blue Bonds: Quick Start Guide. Asian Development Bank.
227 ADB (2021b). Green and Blue Bond Framework. Asian Development Bank.
228 Roth, N., Thiele, T. & von Unger, M. (2019) Blue Bonds: Financing Resilience of Coastal Ecosystems: A technical guideline prepared for IUCN GMPP.
229 De Vos, K. et al. (2020) The Ocean Finance Handbook. Friends of Ocean Action, 2020.
230 UNEPFI (2021) The Rising Tide. Mapping Ocean Finance for a New Decade. UNEP.
231 Such as www.unepfi.org/blue-finance/the-principles or www.fisheriesprinciples.org.
232 www.fsb-tcfd.org
233 https://bluenaturalcapital.org/bncff-blue-prints/
234 Amon, D. .et al. (2021) Seven Asks for the G7. IPSO Brief.
235 Thiele, T., Alleng, G., Biermann, A. et al. (2020) Blue Infrastructure Finance: A new approach. integrating Nature-based Solutions for coastal resilience. IUCN.
236 https://www.iucncongress2020.org/motion/062
237 Turley, C., Racault., M-F, Roberts, M., et al. (2021) Why the Ocean Matters in Climate Negotiations. COP26 Universities Network Briefing.

9. CAPACITY DEVELOPMENT

9.1 Building capacity for the ocean in a changing climate: Update 2021

Capacity development integrating the ocean and climate change is being undertaken by different organizations in different contexts. Internationally, the IOC of UNESCO is playing a prominent role through their capacity development programmes, as well as the UN Decade of Ocean Science for Sustainable Development. Aquariums, science centres and museums also have an important role in educating and empowering youth and the general public. This section provides and overview of selected capacity development initiatives and innovative approaches, providing specific examples of ongoing efforts and future needs.

IOC Capacity Development Updates

In 2017 IOC-UNESCO established the IOC Group of Experts on Capacity Development (GE-CD). The Group is tasked with *inter alia* undertaking capacity development needs assessments, starting the implementation of a clearing house mechanism and developing a revised IOC Capacity Development strategy.

Since its first meeting in 2018 the GE-CD has successfully undertaken two global scale CD Needs Assessments, via on-line surveys. Whilst the first survey identified clear needs and regional trends, an expanded second survey[238] was undertaken between September 2020 to February 2021 which widened the overall CD stakeholder groups to capture a holistic understanding of ocean science capacity expertise and capacity gaps, including human resources, infrastructure, coordination, communication and policy. In general, what can be drawn from the survey results is the strong expression of a need for capacity enhancement on ocean science in all areas. In terms of the most critical CD needs, there was a clear priority, across all regions and groups for *funding and investment followed by ocean observation equipment (buoys, AUVs, tide-gauges etc.)*. The second survey also captured specific needs of relevance to the United Nations Decade of Ocean Science for Sustainable Development (2021-2030)[239](Ocean Decade). In the context of the Challenges, the greatest CD needs identified were related to Challenge 4: *Generate knowledge, support innovation, and develop solutions for equitable and sustainable development of the ocean economy under changing environmental, social and climate conditions and Challenge 7: Ensure a sustainable ocean observing system across all ocean basins that delivers accessible, timely, and actionable data and information to all users.* More information on opportunities provided by the Decade is provided in chapter 9.2.

Given the requirements in the IOC Criteria and Guidelines on the Transfer of Marine Technology (IOC/INF-1203) the GE-CD undertook efforts to identify means by which to provide interested users in Member States with direct and rapid access to relevant sources of information and practical expertise in the Transfer of Marine Technology (TMT), as well as to facilitate scientific, technical and financial cooperation to that end. The outcome of the Group's efforts resulted in the development of the IOC Ocean InfoHub (OIH).[240]

The GE-CD is also currently working to develop a revised IOC Capacity Development Strategy, anticipated to be endorsed by the IOC Assembly in 2023. Guided by the outcomes of the IOC CD Needs Assessments the updated Strategy will align with the CD objectives of the Ocean Decade, with other organizations' CD efforts, including those within the UN Oceans family, as well as with the expectations of other international processes, such as the negotiations 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 (General Assembly resolution 72/249) - BBNJ. The IOC CD Strategy will aim to address current challenges, including climate change, biodiversity and habitat loss and their impact on marine resources, services, observation systems, etc., at local and global scales.

9.2 Building ocean science capacity for climate action: The UN Decade of Ocean Science for Sustainable Development 2021-2030

In December 2017, the United Nations General Assembly proclaimed the United Nations Decade of Ocean Science for Sustainable Development from 2021 to 2030 (the Ocean Decade). The Ocean Decade has a vision of the 'science we need for the ocean we want'. It is a once in a life-time opportunity to deliver a step-change in the generation and use of ocean science. It will influence how countries invest and participate in science and innovation to embrace societal goals and align research investment to contribute to common goals including the 2030 Agenda.

The Ocean Decade commenced on 1st January 2021 and its implementation is being coordinated by IOC-UNESCO. The Ocean Decade Implementation Plan will guide

238 The detailed outcomes of the survey were published on https://surveys.ioc-cd.org
239 https://unesdoc.unesco.org/ark:/48223/pf0000376780.locale=en
240 https://oceaninfohub.org/

the roll-out of the Ocean Decade over the next ten years and identifies *inter alia* a series of ten Ocean Decade Challenges as a fundamental part of the Decade Action Framework. These Challenges will convene partners to achieve collective impact by facilitating the co-design and co-delivery of transformative ocean science by diverse groups of partners. The focus of the Ocean Decade is on solutions-oriented science that fills critical knowledge gaps to inform global and regional policy processes - including processes of the UNFCCC - and to generate knowledge needed by governments, industry, and resource managers amongst others. The ocean-climate nexus is one of the ten Ocean Decade Challenges, and climate change mitigation and adaptation considerations are cross-cutting across the majority of the remaining nine Challenges.

The Ocean Decade will achieve its impact through the implementation of Decade Actions that will be co-designed, implemented and resourced by partners around the world to meet the Ocean Decade Challenges. The successful roll-out of the first Call for Decade Actions was launched on 15 October 2020 and closed on 15 January 2020. On 5 June 2021, the Executive Secretary of IOC and ADG/IOC endorsed 34 Ocean Decade programmes and 66 Ocean Decade contributions as the first set of flagship Decade Actions. These Decade Actions were selected for their transformative nature, their solutions-oriented focus that will result in tangible contributions to sustainable development, and their commitment to Ocean Decade principles including inclusivity and diversity. The first set of the Decade Actions covers diverse themes including climate resilience and mitigation, ocean science to support policy development in Pacific SIDS, ocean literacy, deep sea research and management, ecosystem management under multiple ocean stressors including ocean acidification and deoxygenation, underwater cultural heritage, ocean observations, coastal resilience, and fisheries. A series of cross-cutting programmes will actively work with the thematic and regional programmes to develop capacity, ensure inclusivity and diversity, and support co-design of future Decade Actions.

The second Call for Decade Actions No. 02/2021 will be launched in October 2021. It will solicit both global programmes, and smaller geographical or time scale projects to populate the existing set of endorsed Decade programmes. The ocean-climate nexus will be a particular focus of the next Call for Decade Actions. Support will be provided to partners in LDCs and SIDS to encourage their full and active participation in Decade Actions. Actions will also be assessed in terms of the degree to which they support capacity development and exchange, and where relevant, their engagement with indigenous and local knowledge holders.

9.3 Empowering civil society and youth

New and innovative ways to empower youth and the general public

The general public has become increasingly concerned about climate change. People now receive a great deal of alarming information on the causes and consequences of climate change from traditional and emerging news and other media sources. They already experience many of these consequences in their daily lives, but their understanding of and engagement with these topics is still varied. They may also not be prepared to evaluate climate-related information in order to form their own opinion on necessary next steps. Phenomena and issues related to climate change and the ocean are complex. There is also a lack of awareness on the links between people's daily lives and the state of the ocean and climate, including what actions they can engage in at a personal level. Showing people that climate change and a healthy ocean are important, and are linked with other problems such as poverty, health and security, is still a significant challenge for climate change adaptation strategies.

In this context, raising the level of societal understanding of climate and ocean issues and empowering the civil society and youth is fundamental for the implementation of effective adaptation and mitigation actions, and bringing change as it has been stated in the Rio Declaration on Environment and Development.[241,242]

The ways of empowering people are changing. A collaborative approach recognises alternative community understanding and knowledge and their role in learning[243] and in empowering people. Citizen science is such a form of informal and experiential learning as participants learn by engaging in science and knowledge sharing. Citizen science has been identified as an effective method for advancing marine conservation and improving marine management by increasing public engagement.[244] For example, in the UK, Capturing Our

241 e.g. principle 1 suggesting that humans are core to the change and efforts needed for a sustainable future; principle 3 stating that future generations should have their say in climate related policies; and principle 10, stating that environmental issues are better handled if managed by citizens at all levels in society.
242 UNESCO, 2019.
243 Kelly R, Evans K, Alexander K, Bettiol S, Corney S, Cullen-Knox C, Cvitanovic C, de Salas K, Lee HS, Liu SY, Yeh T-K (2019) Marine education through cooperation: a case study of opportunity in a remote school in Taiwan exemplary practices in marine science education–a resource for practitioners and researchers. In: Fauville G, Payne DL, Marrero ME, Lantz-Andersson A, Crouch F (eds) International Publishing. Springer, Cham.
244 Danielsen F, Pirhofer-Walzl K, Adrian TP, Kapijimpanga DR, Burgess ND, Jensen PM, Bonney R, Funder M, Landa A, Levermann N, Madsen J (2014) Linking public participation in scientific research to the indicators and needs of international environmental agreements. Conserv Lett 7(1):12–24.

Figure 5: Public and youth engagement activities. Photos © Nausicaá

Coast (COCOAST) and The Shore Thing projects improve knowledge of marine biodiversity while collecting data about the impacts of climate change.[245]

The young people of today are increasingly online, around 50% of those aged 18-24 are likely to prefer accessing news via social media, news aggregators, and mobile alerts.[246] Social media can allow connections to form between people on opposite sides of the world, and it can inspire global movements (such as Fridays for Future).

Studies show that due to their visual nature, social media have heightened public awareness regarding conservation and management strategies, as well as possible threats posed to wildlife.[247] **Virtual reality** (VR) and **augmented reality** (AR) experiences are fun, immersive, and spark emotional connections, which helps create a long lasting mind-set of change when used to communicate environmental issues. Immersive media like AR and VR can reach audiences in new ways, and impact those who do not have access to the ocean themselves.

Furthermore, empowering society and communities for adapting ocean and climate friendly new behaviour patterns can take place via open innovation, co-creation processes and collective production of new knowledge with a user-centric approach. **Living labs**, "life-size open innovation environments in which users participate in the creation of new services, products and societal infrastructure", are a phenomenon that started in the late 1990s[248] and has been expanding rapidly in the recent days.

Local and traditional knowledge can also play a critical role in gaining understanding of the ocean, and is recognised as an important component of ocean literacy and community empowerment.[249] The transfer of traditional community knowledge and practices between groups and generations creates exchanges and relationships where learners can see and value their own experiences and knowledge. Many of these traditional connections to the ocean are shared and developed across cultural and artistic practices such as local customs and social traditions, music, dance, poetry, sculpture, painting, film, theatre, literature, religion and mythology.[250] Sea festivals and open science days can play a central role in the intergenerational exchange of cultural knowledge about oceans and coasts.

Role of aquariums, science centres and museums

Aquariums, science centres, museums and other informal educational organizations can have an important role in raising awareness of ocean and climate issues in society at large. Visited by hundreds of millions of people each year, they work with many different stakeholders: policy makers, scientists, media, educational institutions, and NGOs, and have a privileged access to the general public. They also work closely with local communities, and can use this relationship to communicate the need to give urgent attention to climate-ocean issues and build a wide public consensus.

Aquariums, science centres and museums have well-developed strategies to translate difficult concepts into easy-to-understand messages in attractive settings and can tailor scientific content to local contexts, languages and narratives, thus enabling meaningful connections that are representative of communities. They can inform the public about sustainable policies, helping them gain acceptance, and involve people in their implementation. Nothing can be done without the commitment of the citizens.

245 Kelly et al. 2021.
246 Reuters, 2021.
247 Wu et al., 2018; Toivonen et al., 2019.
248 Dosseur B, Amourous T, Millet F, Artheau M, Battais L, Fuentes R, Laval D, Maggioni L (2014) Living Lab. A New Form of Relationship with the public. Immediats, Cretaive Commons.
249 Kelly et al.2021

250 Zurba M, Berkes F (2014) Caring for country through participation art: creating a boundary object for communicating Indigenous knowledge and values. Local Environ 19(8):821–836.; Hobart HJ (2019) When we dance the ocean, does it hear us? J Trans American Stud 10:1.


Figure 6: Aquariums raise awareness of ocean and climate issues. Photos © A-Beyaert, Nausicaá

Aquariums, science centres and museums can encourage people to act and adopt more sustainable ways of life. Through specific surveys, knowledge gaps can be identified. Ocean and climate information such as sea-level rise, coastal adaptation, ocean warming, ocean acidification, deoxygenation, ocean-based solutions for mitigation, and positive initiatives and actions can be presented to the public through exhibits (including multimedia, aquariums, settings, informative panels, digital and immersive experiences), events, educational material, web-based contents, and traveling exhibits. Other tools such as public education and outreach activities, specific projects for young people and teachers, can represent information multipliers for diverse audiences (school children, students, families) who don't come to visit their exhibitions. They also develop and share communication techniques and tools for professionals who wish to raise public awareness on ocean related questions in their own organizations.

Moreover, engagement in **ocean-centred leisure activities** (i.e. fishing, sailing, beach-going, etc.) provides experiential learning opportunities that can engender positive social experiences resulting in an appreciation of the marine environment, deeper personal connections to the ocean, and stronger attachments.[251]

The Ocean Literacy programme of IOC-UNESCO

Ocean Literacy has been historically defined as 'the understanding of human influence on the ocean and the ocean's influence on people'. Ocean literacy is not only about increasing awareness of the state of the world ocean, including in mitigating, and providing responses to adapt to climate change; it is also about providing approaches and tools to transform ocean knowledge into actions that promote ocean sustainability.

Ocean literacy involves both formal and non-formal education. In a broad and comprehensive context, ocean literacy can be adapted to local contexts and has been referred to under different terms, including 'marine education', 'ocean education', among others.

The IOC-UNESCO ocean literacy framework is made of 7 Essential Principles, and one of them, principle 3, highlights the role of the ocean in the climate system, although still limited is the appreciation of this connection for many students around the world. Learners are taught to recognize the individual components of the Earth biogeochemical cycles, such as the water and carbon cycles, but many are not cognizant of the interactions and interdependence of these components in making up whole Earth systems. Future efforts should be made to include, in the formal educational curricula, an ocean and climate literacy approach that would not only increase the understanding of the phenomena at hand but also add a 'take action' and 'empowerment' components needed to encourage everyone to take an active role in the search for solutions of the climate crisis.

IOC-UNESCO announced a voluntary commitment called "Ocean Literacy for All", at the first UN Ocean Conference (New York, June 2017). The implementation of the voluntary commitment started immediately after and led to the launch of numerous other initiatives.

In July 2018, the IOC Ocean Literacy Portal was launched to serve as a repository for quality education and information tools, resources, good practices and local or international success stories. In 2018, a partnership was established with the Ocean Frontier Institute, Dalhousie University and the National Film Board of Canada to develop a feasibility study for the internationalization of the Ocean School Programme. Ocean School is an ocean science educational programme, which uses storytelling techniques, immersive technologies and interactive media to promulgate ocean literacy. An Ocean School Teacher Training Workshop was organized in San José, Costa Rica (3–4 December 2018), in collaboration with the UNESCO Office, to test the possibility of adapting the Ocean School programme

251 Ainsworth GB, Kenter JO, O'Connor S, Daunt F, Young JC (2019) A fulfilled human life: eliciting sense of place and cultural identity in two UK marine environments through the community voice method. EcosystServ 39:100992.

and technology to different educational systems and geographical and cultural contexts.

Between 2018 and 2019 a pilot test phase of the Ocean Literacy for All: A Toolkit[252] started in collaboration with the UNESCO Network of Associated Schools (ASPNet). The toolkit is meant to provide educators and learners with innovative tools, methods and resources to understand ocean processes and functions, to alert them on the most urgent ocean issues, and to provide ready to use activities to be implemented in formal and non-formal educational contexts. The toolkit was tested in schools of 36 countries.

Beyond education, the Ocean Literacy programme has involved other sectors of civil society, e.g. the private sector, with a dedicated pilot workshop held in 2019, aimed at enabling and scaling up action in all sectors of society regarding Ocean sustainability.

In 2020-2021, a Framework for Action for Ocean Literacy in the United Nations Decade of Ocean Science for Sustainable Development was developed, with the aim to inspire a new generation of ocean citizens.[253]

9.4 Success stories and future needs

There are a number of success stories from around the world of initiatives that have built capacity on ocean and climate issues for the general public and youth. Some of them are highlighted below, along with future needs.

Success stories

The European Coalition for Ocean Literacy (EU4Ocean) connects diverse organizations and people that contribute to marine science education and the sustainable management of the ocean. They focus on particular topics: Climate and Ocean, Food from the Ocean, and Healthy and Clean Ocean. Supported by the Directorate General for Maritime Affairs and Fisheries of the European Commission, this bottom-up inclusive initiative offers a dynamic topic-oriented environment that stimulates collaboration, and exchange of practices and dialogue across the many different target groups leading to the creation of new ocean literacy partnerships and innovative actions, co-designed by organizations and the youth.

The coalition is made up of three communities: an EU4Ocean Platform for organizations and individuals engaged in ocean literacy initiatives, a Youth4Ocean Forum and a Network of European Blue Schools. The European Ocean Coalition brings together members across Europe and beyond.

The Youth4Ocean Forum is a free platform for young people between 16 and 30 years old. Their common goal is to tackle the climate crisis, fight marine pollution, ensure food security and shape their future with a healthy ocean. The Youth4Ocean Forum provides these young people with the opportunities to speak up for their generation in front of European and international institutions, share their ideas and connect with like-minded young people and experts all over Europe. The Forum empowers the youth to solve challenges facing the ocean, such as e.g. climate change by helping them to develop and promote their individual projects in the field, obtain accreditation of EU Young Ocean Advocates and enable them to get involved in policy, research, scientific mediation and awareness-raising.

The Network of European Blue Schools brings the ocean into the classroom. A Blue School takes up the “Find the Blue,” challenge and commits to developing a community project that addresses a marine and societal challenge. The project enables pupils to gain knowledge and skills by working on an ocean topic for an extended period of time, improving their connection to the ocean and developing a sense of responsibility towards it. This feeling of responsibility for the ocean empowers the pupils to make ocean-friendly, sustainable consumer choices and become citizens of the global ocean.

In the Asia Pacific region, the Asia Pacific Water Summit Youth Forum will be held in April 2022, and is expected to bring together online 5,000 youth from 50 countries to set up an action plan and prepare a Youth Declaration for balancing climate change, ocean conservation, and economic development. Youth participants will introduce to each other regional activities for ocean conservation and climate change.

The Interreg-Med Blue Growth Community aims to mainstream and capitalize on the main results/tools of the Community’s projects to foster blue growth in the Mediterranean. Creating a community around projects capitalizing on best practices related to the sea aims to streamline multiple efforts and initiatives and speed up sustainable blue growth in the ocean.

The RISE UP – A Blue Call to Action has grown since its launch in 2020 and has now amassed a network of over 500 civil society organizations around a common, ambitious and forward-looking ocean agenda. Such an agenda and network will be able to collectively lend weight, where needed to push for transformative ocean action this decade. Ultimately, this will help build the

252 F. Santoro et al. (eds). 2017.Ocean Literacy for All - A toolkit, IO-UNESCO & UNESCO Venice Office, Paris (IOC Manuals and Guides, 80 revised in 2018)
253 UNESCO-IOC. 2021. Ocean Literacy Framework for the UN Decade of Ocean Science for Sustainable development 2021–2030. Paris, UNESCO. (IOC Ocean Decade Series, 22.)

much-needed momentum required for recognition of the importance of the ocean in an international level.

Future needs

Although the ocean and climate literacy of youth is perceived to be increasing[254], due to ocean literacy school curricula in some regions,[255] developing awareness of ocean and climate issues is difficult to achieve through curricula and formal education activities alone. This is challenging when considering that the youth are generally excluded from decision-making processes.[256] It is usually adults who engage in decisions that impact the ocean and who have the power to drive a change through voting behaviour, lobbying governments and involvement in decision making processes.[257] Improving opportunities for ocean and climate social empowerment requires better access to comprehensive learning across all age groups and layers of society, including those with a limited access to the ocean (i.e. disadvantaged and/or landlocked communities).

254 Lee et al. 2019.

255 Fauville G, Payne DL, Marrero ME, Lantz-Andersson A, Crouch F (2018) Exemplary practices in marine science education: a resource for practitioners and researchers. Springer, Cham.

256 Gal T (2017) An ecological model of child and youth participation. Child and Youth Serv Rev 79:57–64.; Botchwey ND, Johnson N, O'Connell LK, Kim AJ (2019) Including youth in the ladder of citizen participation. J American Plan Assoc 85(3):255–270.

257 romen A, Colin P (2010) Everday youth participation? contrasting views from Australian policy makers and young people. Young 18(1):97–112; Gal 2017.

10. THE OCEAN, CLIMATE CHANGE, AND COVID-19

Since the last ROCA report in 2019, the COVID-19 pandemic has ruptured normalcy causing profound suffering and loss, disrupting economic activity, and affecting the lives of ocean depending coastal communities.[258] It has also caused the cancellation of ocean and climate meetings, slowed down policy processes, impacted funding levels and slowed down scientific research. At the same time, COVID-19 has also been a catalyst for some important innovations that have allowed the ocean-climate work to carry on. This section will provide a summary of the impacts of COVID-19 on the ocean-climate nexus.

Ocean conservation and the ocean-climate interface have been impacted in many ways by the COVID-19 pandemic. Funding for marine protected areas management, other marine management and ocean science have suffered, with visitors staying away from MPAs and funders shifting priorities.[259,260] There has been an increase in the generation of marine litter that includes disposable masks, plastic gloves and hand sanitizer bottles,[261] as well as a decrease in waste recycling.[262,263] Impacts on fisheries included a decline in the demand for seafood, at least in the short term, following closure of restaurants, decrease in prices, labor shortages, and supply chain disruptions that have highlighted the vulnerability of food systems.[264] The short- and long-term effects of COVID-19 risk further marginalizing many small-scale fisheries and coastal communities, including women, who are already vulnerable to a myriad of social and environmental changes.[265] Blue economies have been further impacted by the loss of tourism jobs and revenue, with SIDS particularly affected.[266] Shipping operations, and as a result global trade flows, as well as seafarers, have also been negatively impacted.[267] There have also been human rights impacts especially for local communities dependent on the ocean.[268]

Some of the other changes that have happened as a result of COVID-19, at least in the short term, have been positive for the environment, such as the rapid decrease in atmospheric pollutants (and associated deaths) arising from decreased transportation, and reduced ocean noise levels that have benefited marine mammals in some locations.[269,270,271] COVID-19 has also highlighted the importance of the ocean as a source of new medicines. For example, Remdesivir, an experimental antiviral derived from sea sponges, has been used in treatment of patients with COVID-19.[272] It is probable that the ocean and its rich, but to a great extent unknown, biological and genetic diversity may yield other future solutions for humankind.

For the climate and ocean community, COVID-19 caused the cancellation of key meetings that many had hoped would make 2020 an important year for the ocean, amongst them the UNFCCC COP 26, which was postponed from November 2020 to 2021, and the 2nd United Nations Ocean Conference postponed from June 2020 to 2022.[273] Several originally postponed meetings have been since held either virtually, or through a hybrid model, including the SBSTA Ocean and Climate Change Dialogue (December 2020), the Oceans Action Day (November 2020), as well as the Informal Consultative Process (ICP) discussing the topic of sea-level rise (June 2021). Overall, the pandemic has improved our ability to come together and communicate virtually, and hold events, even large events, without the need to travel.

For governments, there has been a re-focus in priorities towards coping with the pandemic and its effects, and planning for recovery. Given the widespread health and economic impacts of the pandemic, and the urgent need for relief measures, some difficult trade-offs had to be made and governments' priorities were re-evaluated. This has caused the postponement, at least by some governments, of planned ocean and climate action, and in some cases the roll-back of environmental legislation.[274]

258 Laffoley, D., Baxter, J. M., Amon, D. J., Claudet, J., Hall-Spencer, J. M., Grorud-Colvert, K., ... & Andersen, N. F. (2021). Evolving the narrative for protecting a rapidly changing ocean, post-COVID-19. Aquatic conservation: marine and freshwater ecosystems, 31(6), 1512-1534.

259 MPA News (2020) MPAs, COVID-19, and the coming financial crisis: What impacts are practitioners already seeing, and how are they responding? MPA News May 2020.

260 Hockings, M., Dudley, N., Ellio, W., Ferreira, M., Mackinnon, K., Pasha, M. et al. (2020). COVID-19 and protected and conserved areas. Parks, 26, 7–24

261 See, for example, CTV News (2020) Single-use plastics ban likely delayed due to pandemic: Environment minister. CTV News May 15, 2020. https://www.ctvnews.ca/politics/single-use-plastics-ban-likely-delayed-due-to-pandemic-environment-minister-1.4941518

262 Klemeš, J.J., Fan, Y.V., Tan, R.R. & Jiang, P. (2020). Minimising the present and future plastic waste, energy and environmental footprints related to COVID-19. Renewable and Sustainable Energy Reviews, 127(C), 109883

263 Zambrano-Monserrate, M.A., Ruano, M.A. & Sanchez-Alcade, L. (2020). Indirect effects of COVID-19 on the environment. Science of the Total Environment, 728, 138813.

264 How is COVID-19 affecting the fisheries and aquaculture food systems, FAO, April 2020.

265 Bennett, N.J., Finkbeiner, E.M., Ban, N.C., Belhabib, D., Jupiter, S.D., Kittinger, J.N. et al. (2020). The COVID-19 pandemic, small-scale fisheries and coastal fishing communities. Coastal Management, 48(4), 336–347.

266 UN/DESA Policy Brief #64: The COVID-19 pandemic puts Small Island Developing economies in dire straits

267 UNCTAD (2021) COVID-19 and maritime transport: Impact and responses. Online at https://unctad.org/webflyer/covid-19-and-maritime-transport-impact-and-responses

268 Sowman, M., Sunde, J., Pereira, T., Snow, B., Mbatha, P., & James, A. (2021). Unmasking governance failures: The impact of COVID-19 on small-scale fishing communities in South Africa. Marine Policy, 133, 104713.

269 Chen, K., Wang, M., Huang, C., Kinney, P.L. & Anastas, P.T. (2020). Air pollution reduction and mortality benefit during the COVID-19 outbreak in China. The Lancet: Planetary Health, 4(6), e210–e212.

270 Zambrano-Monserrate, M.A., Ruano, M.A. & Sanchez-Alcade, L. (2020). Indirect effects of COVID-19 on the environment. Science of the Total Environment, 728, 138813.

271 Ocean Networks Canada (2020) Hushed Seas: monitoring underwater noise during COVID-19 online at https://www.oceannetworks.ca/hushed-seas-monitoring-underwater-noise-during-covid-19

272 Thiele, T., Imbert, M.-C. and Bouley, T. (2020) A healthy ocean can help fight pandemics. Chinadialogue Ocean. https://chinadialogueocean.net/13619-healthy-ocean-help-fight-pandemics/ and GILEAD news release at https://www.gilead.com/stories/articles/an-open-letter-from-our-chairman-and-ceo-april-29

273 The 2nd UN Ocean Conference is now set to take place from 27 June to 1 July 2022 in Lisbon, Portugal.

274 For example, Tollefson, J. (2020). Five ways Trump is undermining environmental health. Nature, 581(7806), 17–18. https://doi.org/10.1038/d41586-020-01261-4 and UN News (2020) COVID-19 environmental roll back 'irrational and irresponsible': rights expert.

Table 3: Six-point post-COVID-19 narrative for the ocean[1]

1 Laffoley, D., Baxter, J. M., Amon, D. J., Claudet, J., Hall-Spencer, J. M., Grorud-Colvert, K., ... & Andersen, N. F. (2021). Evolving the narrative for protecting a rapidly changing ocean, post-COVID-19. Aquatic conservation: marine and freshwater ecosystems, 31(6), 1512-1534.

1. All life is dependent on the ocean

We depend on the ocean for all life on Earth; it nurtures us, but we have done woefully little to nurture it

2. By harming the ocean, we harm ourselves

All ocean activities need to be carried out more responsibly with the curtailment of damaging actions that affect current and future values

3. By protecting the ocean, we protect ourselves

Humanity's reliance on the ocean means we must protect it to protect ourselves

4. Humans, the ocean, biodiversity and climate are inextricably linked

The ocean modulates the climate and humans influence the state of the ocean and its biodiversity—what is needed is joined-up action and solutions

5. Ocean and climate action must be undertaken together

If you are not factoring in ocean impacts and solutions, you are not effectively addressing climate breakdown

6. The degree of ocean change requires action now

We have no choice. We need to act now or risk closing off future options for action

At the same time, there is a growing sentiment among many that COVID-19 provides an opportunity to build back smarter, in a way that allows us to re-imagine for the better our economies and our relationship with the environment, including the ocean. One example of this thinking is the EU's Green Deal of 2019,[275] which was supplemented by a Green Recovery Plan in 2020.[276]

The COVID-19 pandemic has provided an opportunity to reflect on our relationship with nature, but the overriding climate and biodiversity crises have not gone away, with emissions and climate impacts continuing to escalate and ocean health continuing to decline. The coordinated response to COVID-19, particularly in the form of vaccine development, demonstrates that rapid global achievements are possible if the world community comes together to support science-based approaches. For humanity to come together to re-imagine its relationship with the ocean, clearer links need to be made between human health, our well-being, and the ocean's fate. This requires a better understanding, by all segments of society, of how human well-being and climate are connected to a healthy ocean.[277] To help improve this understanding, a workshop of leading marine scientists participating in the International Programme on the State of the Ocean created a post-COVID-19 narrative for the ocean (Table 3).

Ultimately, the COVID-19 pandemic has demonstrated that humanity and the systems we rely upon are dependant on a healthy, vibrant and diverse natural world, including the ocean. Though we view ourselves as terrestrial animals, the ocean plays a pivotal role in the planetary system and our daily lives. The pandemic response has also shown that when there is a direct threat to life, governments can act and innovate rapidly and by and large the general population supports such actions. This case-study of large-scale action demonstrates that there is potential for rapid and effective measures to combat the ocean crisis and climate emergency should it be recognised fully.

https://news.un.org/en/story/2020/04/1061772

275 EU. (2019). A European green deal: Striving to be the first climate-neutral continent. Online at https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal_en

276 EU. (2020). The EU budget powering the recovery plan for Europe. Online at https://ec.europa.eu/info/files/eu-budget-powering-recovery-plan-europe_en

277 Laffoley, D., Baxter, J. M., Amon, D. J., Claudet, J., Hall-Spencer, J. M., Grorud-Colvert, K., ... & Andersen, N. F. (2021). Evolving the narrative for protecting a rapidly changing ocean, post-COVID-19. Aquatic conservation: marine and freshwater ecosystems, 31(6), 1512-1534.

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11. ROCA SUMMARY AND WAY FORWARD

11.1 Brief summary of ROCA Achievements

The Roadmap to Oceans and Climate Action is a global multi-stakeholder initiative involving governments, international agencies, NGOs, scientific institutions, private sector, and subnational authorities to advance the oceans and climate agenda (especially in the UNFCCC, the UN Ocean Conference, and in other United Nations fora), and at the national level in all countries. ROCA was launched at the UNFCCC COP 22 in Marrakech, Morocco. The ROCA works to implement the Strategic Action Roadmap on Oceans and Climate: 2016-2021, first discussed at the Oceans Day at COP 21 in Paris 2015, and then prepared in detail by 37 international experts throughout 2016 and highlighted at the Oceans Action Day at COP 22 Marrakech in 2016.

ROCA is led by the Global Ocean Forum, IOC UNESCO, Ocean Policy Research Institute of the Sasakawa Peace Foundation, Japan, and the Oceano Azul Foundation, Portugal.

The Roadmap presents recommendations in six major areas which ROCA aims to advance:

1. Central role of oceans in regulating climate;
2. Mitigation;
3. Adaptation and Blue Economy;
4. Displacement;
5. Financing; and
6. Capacity development, for implementation in 2016 through 2021.

For each of these issues, the Roadmap has addressed: 1) the current status of the issue (and, as relevant, the science related to the issue); 2) the current state of play of the issue within the UNFCCC; 3) the opportunities and pathways that may be available within the UNFCCC to advance the issue in 2016-2021; 4) the opportunities and pathways that may be available outside of the UNFCCC to advance the issue; and 5) financial considerations regarding each issue.

Activities

All six areas that ROCA aims to advance are addressed in the *Assessing Progress on Ocean and Climate Action: Reports of the Roadmap to Oceans and Climate Action (ROCA) Initiative*. These reports comprise an annual series of assessments of ocean and climate science, policy, and action organized by ROCA. Following the organization of the Strategic Action Roadmap to Oceans and Climate Action: 2016-2021, these progress reports have addressed the following issues which must be addressed at all levels of policy as an interrelated "package" of issues, including, inter alia: recognizing the central role of oceans in climate; using ocean-based mitigation approaches (such as Blue Carbon, reducing air emissions from ships, renewable energy; carbon capture and storage); deploying a wide variety of adaptation measures, especially based on ecosystem approaches; fostering the low carbon Blue Economy; addressing the issues of human displacement; and providing adequate provision of financial flows and of capacity development. Four reports including this volume (2016-2017; 2018; 2019; 2020-2021) have been prepared involving 92 authors.

The ROCA initiative has led the organization of Oceans Action Days at COPs 22, 23, 24 and 25, in collaboration with key Parties and non-Party stakeholders in the ocean community. Oceans Day at COP21 in Paris was a landmark event that helped push the ocean and climate agenda to its inclusion as one of the eight priorities to be fast-tracked under the Marrakech Partnership for Global Climate Action. COP22 saw a strong presence of the ocean community representatives who continued building the momentum and raising awareness on the relevance of ocean-related issues in the climate change realm, including through Oceans Action Day at COP22. The COP23 Oceans Action Day focused on action on the ground and showcased lessons learned, best practices and recommendations for replication and upscaling of successful experiences going forward as the Paris Agreement is further implemented. The COP24 and COP25 Oceans Action Days focused on promoting the oceans agenda at the COP and on developing cooperation and coherence in policies and programs at multiple levels to implement a comprehensive strategy on oceans and climate, both within and outside the UNFCCC process. The Virtual Oceans Action Day 2020 held in memory of GOF President Dr. Biliana Cicin-Sain took stock of progress on oceans and climate issues towards UNFCCC COP26 in Glasgow, including outcomes of the discussions at the Ocean and Coastal Zones Thematic Group Race-to-Zero November Dialogues under the Marrakech Partnership and perspectives on the UNFCCC SBSTA Ocean and Climate Change Dialogue to consider how to strengthen adaptation and mitigation action held from 2 to 3 December 2020.

For COP26, a Virtual Ocean Pavilion is being organized within the framework of the ROCA Initiative, which aims to showcase why the ocean matters in climate negotiations and to all life on our planet. It aims to increase knowledge, commitment and action for the ocean-climate nexus at the UN Climate Conference in Glasgow this November. A virtual format ensures that the Pavilion is able to respond to changes in the COP26 schedule as affected by the current pandemic and will reach a much wider audience than just those able to attend COP26 in person.

Results and Impacts

The ROCA initiative promoted the wide dissemination of information targeting decision-makers at the UNFCCC and beyond emphasizing the undeniable evidence of the importance of oceans, the central role the oceans play in regulating the climate system, and the dire consequences of inaction, especially through the organization of Oceans Action Days at the COPs and through the ROCA Initiative's annual reports on Assessing Progress on Ocean and Climate Action. The 2019 report highlighted the findings of the IPCC Special Reports on the Ocean and Cryosphere in a Changing Climate and on Global Warming of 1.5°C, emphasizing that the predictions of climate change impacts on oceans and coastal communities will happen much earlier than expected.

Oceans Action Days at the COPs were key events that spurred discussions on how best to tackle oceans and climate challenges. Along with an increasing number of oceans events at the COPs, Oceans Action Days have built on the momentum to include oceans on the agenda that has reached a crescendo at COP25. Attention has been drawn to the importance of innovative strategies on the way forward such as a global ocean alliance to champion an increase by 30% of global oceans under MPAs by 2030 to deliver blue nature-based solutions.

Oceans Action Days at the COPs assessed existing ocean and climate action and identified the gaps that need to be addressed. While there has been some discussion and work in various bodies and processes of the UNFCCC on the oceans and climate nexus, these do not correspond to the magnitude and importance (environmental, social, and economic) of the oceans and climate interface. The Oceans Action Day at COP25 highlighted, in particular, the policy implications of the IPCC Special Reports on the Ocean and Cryosphere in a Changing Climate and on Global Warming of 1.5°C and debated possible avenues for policy actions in response to these analyses. The COP25 decision, *Chile Madrid Time for Action*, reflected a resounding recognition of the critical importance of the ocean in the climate change agenda, which is a major step towards ROCA's goal of advancing the oceans and climate agenda at the UNFCCC, other UN fora, and at the national level.

11.2 What next for ROCA?

A reflection meeting is planned in the spring of 2022 to assess the extent to which and how the Initiative has accomplished its goals and draw lessons learned from its 5-year implementation. The information from this activity will inform the planning of a successor initiative for the oceans and climate community going forward.

Among the considerations to be addressed in the planning process are: 1) Expansion of the ocean and climate community's engagement to include organizations which have a comparative advantage in leading the work on the candidate priority areas of the new strategy; 2) Establishment of an informal but stable funding mechanism to support the implementation of the new strategy; and 3) Keeping track of and building on how its initiatives are able to successfully contribute to the achievement of the Paris Agreement targets.

11.3 Key areas for future action

Based on the findings of this report on the six major areas which ROCA aimed to advance, the following are a few of the key areas identified for future action by the ocean and climate community for consideration during the development of a successor strategy to the ROCA Initiative:

1) Promote the current trajectory set in motion by Parties and non-Party stakeholders, including the Ocean Pathway Partnership, Because the Ocean, among others, to pursue a proper recognition of the importance of oceans in the climate change process and ambition under the Paris Agreement, which was bolstered by the findings of the IPCC Special Report on the Ocean and Cryosphere in a Changing Climate and the IPCC Special Report on Global Warming of 1.5°C, and which became the springboard for greater oceans and climate action and the setting of higher ambitions for oceans and climate action.

2) Explore and exploit the opportunities and pathways that may be available within the UNFCCC to advance the ocean and climate nexus, including:

    a. Promote the adoption of the Ocean and Coastal Zones action pathway under the Marrakech Partnership for Global Climate Action at the regional, national, and sub-national levels, the achievement of the 2030 Race to Zero Break-through target for oceans and coastal zones, and development of cross-sectoral cooperation and collaboration on ocean and climate change action among stakeholders under the MP-GCA platform.

b. Support the pursuit of the recommendations emanating from the SBSTA Ocean and Climate Change Dialogue, including:

i. strengthening cooperation and synergies among relevant UN bodies in tackling ocean and climate change;

ii. further strengthening the ocean-climate nexus under the existing UNFCCC processes; and

iii. empowering Parties and non-Party stakeholders to carry out increased ambition that includes ocean action and integrating ocean-based solutions into NDCs, NAPs and other national processes through science, finance, and capacity building.

3) Promote the strengthening of finance, technology transfer, and capacity-building and public outreach, among other cross-cutting support for ocean-based mitigation and adaptation strategies.

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