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Assessing Progress on Ocean and Climate Action: 2019

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

ROCA
COP 25

Central Role of Oceans in Climate | Mitigation | Adaptation and Blue Economy | Displacement | Financing | Capacity Development

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**Authors are participating in their informal capacities*

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ROCA Leadership

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2019 Progress Report Collaborating Organizations

Global Ocean Forum | United Nations Climate Change | European Commission | Fiji | Oceans & Law of the Sea United Nations | OPRI | Ocean and Climate Platform | CARICOM | Pacific Community Communauté du Pacifique | PML Plymouth Marine Laboratory

United Nations Educational, Scientific and Cultural Organization | Intergovernmental Oceanographic Commission | IPCC Intergovernmental Panel on Climate Change | Scripps Institution of Oceanography | Food and Agriculture Organization of the United Nations | The Carbon Institute | International Alliance to Combat Ocean Acidification | Because the Ocean | IUCN | The Nature Conservancy Protecting nature. Preserving life.

Conservation International | IMO | Acadia University | Coastal Zone Canada Association | IOM UN Migration | Red Cross | Duke Nicholas Institute | Ocean Trust

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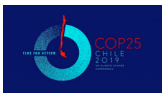

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Table of Contents

List of Boxes, Figures and Tables

Boxes

Figures

Tables

Foreword

We are pleased to present the **2019 Progress Report on Oceans and Climate** being released at the UNFCCC COP25, under the Presidency of Chile, and hosted by the Government of the Kingdom of Spain and being held in Madrid Spain from December 2 to 13, 2019.

This is the third report in an annual series of assessments of ocean and climate science, policy, and action in 2019 organized by the Roadmap to Ocean and Climate Action (ROCA) Initiative. Following the organization of the *Strategic Action Roadmap to Oceans and Climate Action: 2016-2021,* the 2019 Progress report addresses the following issues which must be addressed at all levels of policy as an inter-related "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.

The Report describes the worrying negative impacts of climate change on ocean ecosystems and coastal and island populations around the world, which have accelerated significantly in recent years, and have been decisively and painstakingly documented through two special reports by the Intergovernmental Panel on Climate Change (IPCC)—the Special Report on 1.5°C and the Special Report on the Ocean and Cryosphere in a Changing Climate SROCC (SROCC).

This year, a record number of colleagues—47 experts from intergovernmental, governmental, and civil society organizations, working in their individual capacities—have provided information and text on various topics and sections of the Report, adding considerable expertise and depth to the discussion of the major topics. We are profoundly grateful for these contributions and very much thank each and every contributor. As well, we are very thankful to the Oceano Azul Foundation, Portugal, and the Ocean Policy Research Institute, Sasakawa Peace Foundation, Japan, for their support in the organization and preparation of the Progress Report.

As the Report reveals, although a great deal of political momentum and public awareness around the relationship between climate and oceans has been mobilized in recent years, the overall picture reveals a need for more urgent action and investment in a wide range of mitigation and adaptation measures; addressing the complex and urgent issues related to population displacement; focusing and enhancing ocean financing; and providing suitable capacity development to protect marine environments and the human populations which depend on them around the world in 183 coastal and island nations.

The Report is being issued as a draft report at COP25, to allow additions/corrections by other colleagues; please kindly send any suggestions for report enhancement to Dr. Miriam Balgos, Global Ocean Forum (mbalgos@udel.edu) by January 15, 2020.

Dr. Biliana Cicin-Sain, President, Global Ocean Forum

OVERVIEW

The Progress Report on Ocean and Climate Action for 2019 addresses progress (or lack thereof) in the following categories: 1. Purpose of the Progress Report and progress achieved at COP24, within the UNFCC framework and in related international fora; 2. The central role of oceans in climate and associated science and policy issues, covering new scientific findings and their policy implications; 3. The central role of Nationally Determined Contributions; 4. Mitigation (including Blue Carbon, curbing air emissions from ships, renewable energy, and carbon capture and storage); 5. Adaptation; 6. Low Carbon Blue Economy; 7. Population Displacement; 8. Financing on Oceans and Climate; and 9. Capacity Development.

The Major Developments of 2019 Related to Oceans and Climate

In its introductory sections, the Progress Report lays out major developments related to oceans and climate taking place in 2019: new scientific findings, progress within various bodies of the UNFCCC, and mobilization of Parties and civil society on the oceans and climate action. Subsequent sections highlight new developments in the areas of mitigation, adaptation, Blue Economy, displacement, financing, and capacity development.

New Scientific Findings

Undeniable evidence of the importance of oceans, the central role the oceans play in regulating the climate system, and the dire consequences of inaction, are the most important development in the past year. The IPCC Report on the Ocean and Cryosphere in a Changing Climate (SROCC), approved and released in September 2019, addresses how the ocean and cryosphere have and are expected to change with continued global warming, the risks and opportunities these changes bring to ocean physics, ecosystems and society, and mitigation, adaptation and governance options for reducing future risks.

The SROCC assessment highlights the urgency of prioritizing timely, ambitious and coordinated action to address unprecedented and enduring changes in the ocean and cryosphere. It shows that the world's ocean and cryosphere have been 'taking the heat' for climate change for decades. Up until now, the ocean has taken up more than 90 percent of the excess heat in the climate system. By 2100, the ocean will take up 2 to 4 times more heat than between 1970 and the present if global warming is limited to 2°C, and up to 5 to 7 times more at higher emissions. The report shows that while sea level has risen globally by around 15 cm during the 20th century and that it is currently rising more than twice as fast and accelerating (A3.1). Sea level will continue to rise for centuries. The frequency of marine heatwaves will be 20 times higher at 2°C warming, compared to pre-industrial levels. They would occur 50 times more often if emissions continue to increase strongly. Even if global warming is limited to well below 2°C, around 25 percent of the near-surface (3-4 meter depth) permafrost will thaw by 2100. If greenhouse gas emissions continue to increase strongly, there is a potential that around 70 percent of the near-surface permafrost could be lost. Additionally, the ocean has taken up between 20 to 30 percent of human-induced carbon dioxide emissions since the 1980s, causing ocean acidification.

The impacts on ecosystem services will have negative consequences for health, well-being and livelihoods for dependent Indigenous peoples, local communities, and the over 65 million people living in low-lying coastal and Small Island Developing State (SIDS) communities, who contribute less than 1 percent of the global greenhouse gas emissions. Specific facts and figures of projected impacts of these development and the policy implications they pose are highlighted in this Overview, especially in the sections on mitigation, adaptation, and population displacement.

As the reader will recall, the SROCC report must also be considered hand-in-hand with the IPCC Special Report on 1.5°C released in October, 2018. As covered in the 2018 Progress Report on Oceans and Climate Action, the 1.5°C Report underlines three major points.

The 1.5°C Report is a landmark report with far reaching implications for all climate change action and with *special relevance to oceans and coasts. It:*

- ***Demonstrates that the predicted impacts of climate change are coming much earlier than expected***-we will most likely reach a warming of 1.5°C as early as 2030 and no later than 2052, posing immediate threats to peoples and ecosystems around the world, especially in 183 coastal countries and SIDS. Global emissions of greenhouse gases have to approach zero already in 2050 to avoid the most harmful consequences. As noted by Panmao Zhai, Co-Chair of IPCC Working Group I, *"One of the key messages that comes out very strongly from this report is that we are already seeing the consequences of 1°C of global warming through more extreme weather, rising sea levels and diminishing Arctic sea ice, among other changes."*
- ***Demonstrates that there is a marked difference between keeping to a 1.5°scenario versus a 2.0 scenario—***under a 1.5°C scenario, displacement of millions of people due to sea level rise, increased frequency and intensity of storms, and other seriously adverse effects may be avoided. Limiting warming to 1.5°C instead of 2°C would reduce the impacts of rising sea levels, lower the likeli-

hood of an ice-free Arctic in summer, and limit coral-reef decline alongside many other negative consequences of increased temperatures.[1] As noted by Hans-Otto Pörtner, Co-Chair of IPCC Working Group II, *"Every extra bit of warming matters, especially since warming of 1.5°C or higher increases the risk associated with long-lasting or irreversible changes, such as the loss of some ecosystems…… Limiting global warming would also give people and ecosystems more room to adapt and remain below relevant risk thresholds."*

-- ***Finds that limiting global warming to 1.5°C would require "rapid and far-reaching" transitions in land, energy, industry, buildings, transport, and cities.*** Global net human-caused emissions of carbon dioxide (CO2) would need to fall by about 45 percent from 2010 levels by 2030, reaching 'net zero' around 2050. This means that any remaining emissions would need to be balanced by removing CO2 from the air. As Jim Skea, Co-Chair of IPCC Working Group III noted, *"Limiting warming to 1.5°C is possible within the laws of chemistry and physics but doing so would require unprecedented changes."*

The implications of the IPCC Report 1.5°C are profound for ecosystems and peoples in the oceans and in the coastal zones of 183 coastal and island nations. As Amjad Abdulla, Chief Negotiator for the Alliance of Small Island States, and IPCC Board member noted: *"The report shows that we only have the slimmest of opportunities remaining to avoid unthinkable damage to the climate system that supports life, as we know it. I have no doubt that historians will look back at these findings as one of the defining moments in the course of human affairs. I urge all civilized nations to take responsibility for it by dramatically increasing our efforts to cut the emissions responsible for the crisis and to do what is necessary to help vulnerable people respond to some of the devastating consequences we now know can no longer be avoided."*

It is clear from both the SROCC and the 1.5°C report that what is at stake is the health of ocean biodiversity and ecosystems, their ecosystem services, the well-being and health of millions of low-lying and coastal communities, and, importantly, the world we leave our children. The more decisively and earlier we act, the more able we will be to address unavoidable changes, manage risks, improve our lives and achieve sustainability for ecosystems and people around the world–today and in the future. The time for action is clearly now, not tomorrow.

1 For instance, by 2100, global sea level rise would be 10 cm lower with global warming of 1.5°C compared with 2°C. The likelihood of an Arctic Ocean free of sea ice in summer would be once per century with global warming of 1.5°C, compared with at least once per decade with 2°C. Coral reefs would decline by 70-90 percent with global warming of 1.5°C, whereas virtually all (> 99 percent) would be lost with 2°C.

Other Scientific Developments

A growing body of literature on ocean deoxygenation reveals key insights about regional and vertical patterns of oxygen loss and the potential drivers, however, mechanistic understanding of oxygen controls remain insufficient; there are large discrepancies between observed and modeled oxygen content of the ocean, particularly in the tropics. Similarly, little is known about how oxygen loss affects ecosystem services regionally, or modeling of the economic and social consequences of ocean deoxygenation.

Recognition of ocean deoxygenation as a major consequence of climate change has grown substantially within the scientific and policy communities over the past year through the efforts of the IOC-UNESCO Global Ocean Oxygen Network and the Kiel Declaration on Ocean Deoxygenation released in conjunction with a major deoxygenation symposium and signed by over 500 scientists.

The recent IPCC Special Report on Ocean and Cryosphere in a Changing Climate has identified deoxygenation alongside ocean warming and ocean acidification as a major threat to ocean ecosystems and human well-being. The failure to mention ocean deoxygenation in the first draft of a new treaty on the conservation and sustainable use of marine biological diversity of areas beyond national jurisdiction led to the generation of a policy brief on deoxygenation.

An IUCN report, *Ocean deoxygenation: Everyone's problem. Causes, impacts, consequences and solutions,* to be released in December 2019, involves 67 scientific experts from 42 institutes in 17 countries, and is the largest peer-reviewed study conducted so far on ocean deoxygenation.

Despite rising awareness, oxygen observations remain sparse, and capacity to make oxygen measurements is limited in developing countries. The mitigation of ocean deoxygenation can be addressed through international efforts to: (i) reduce the greenhouse gas and particulate (black carbon) emissions that cause atmospheric and ocean warming and partly ocean acidification; and (ii) reduce nutrient inputs to the ocean that exacerbate oxygen loss.

The oceans have taken up about 25 to 30 percent of the anthropogenic carbon dioxide emitted to the atmosphere since the 1980s causing ocean surface waters to become more acidic and pH to decline by 0.17 to 0.27 pH units per decade. Reductions in ocean carbonate saturation, place stress on animals that produce calcium carbonate skeletons (e.g., pteropods, shellfish, corals) and will contribute to dissolution of the non-living component of the habitat formed by skeletal rubble.

Understanding derived from studies of natural CO2 gradients associated with natural seepage reveals that acidification causes loss of biodiversity (e.g., a 30 percent drop in biodiversity from pH 8.1 to 7.8), degradation of reef habitat, dominance by non-calcifying species, and reduction in size and abundance of calcifying species, leading to overall poor ecosystem status. The combined impact of higher temperature with ocean acidification is particularly problematic for tropical corals.

As of October 2019, the Global Ocean Acidification Observing Network (GOA-ON) has more than 650 members from over 90 countries, and the need for monitoring of ocean acidification and its impacts on marine ecosystems has been recognized at intergovernmental levels including by the UN General Assembly, the UN Convention of Law of the Sea, the Convention on Biological Diversity and the Intergovernmental Panel on Climate Change.

The Paris Agreement does not mention ocean acidification or deoxygenation or their ability to undermine the environmental pillars of sustainable development. In development of nationally determined contributions to reduce emissions under the Paris agreement, fourteen countries mention ocean acidification, but only one addresses oxygen loss.

Individually and in combination, nearly all climate drivers (warming, oxygen loss, ocean acidification, and sea-level rise) are altering ocean ecosystems, from the sea surface to the deep seafloor.

2. Incremental Progress Within UNFCCC on oceans and climate taking place in various bodies/fora of the UNFCCC

The Subsidiary Body for Scientific and Technological Advice (SBSTA) of the UNFCCC under the Research and Systematic observation agenda item encourage Parties and relevant organizations to address and invest in systematic observation and research of the ocean and its role in the global climate system. The Research Dialogue: Science for transformation, held on 20 June 2019 in conjunction with SBSTA 50, promoted discussion at the science–policy interface including on the role of the ocean in the climate system. The Earth Information Day during SBSTA 51 (COP25) will present the state of the global climate, implementing Earth observation, including of the ocean, and observation support for decision making.

At SBSTA 50, the SBSTA mandated that the focus for the Nairobi Work Programme on impacts, vulnerability, and adaptation to climate change (NWP) during 2019 and 2020 should be on oceans, coastal areas and ecosystems. Additionally, as part of the work of the Warsaw International Mechanism on loss and damage (WIM) 5 year work programme, the Executive Committee of the WIM is working with the Technology Executive Committee (TEC) to prepare a policy brief on technology to avert, minimize and address loss and damage in coastal zones.

National Adaptation Plans (NAPs) continued to be submitted to the secretariat in 2019 and, to date, all NWPs include projects on ocean and coastal zone. In continuation of the strong relationship between the IPCC and COPs, a joint SBSTA-IPCC special event: Special report on the Ocean and Cryosphere in a Changing Climate (SROCC) will be held at COP25 during SBSTA 51 on Thursday 5 December, 2019.

One should note, however, that notwithstanding this incremental progress, these measures do not yet correspondence to the magnitude and importance (environmental, social, and economic) of the oceans and climate interface.

3. Significant mobilization of Parties to the UNFCCC and in other global fora around the issues of climate and oceans fueled by the implications of the scientific findings

Mobilization of Parties to the UNFCCC on the oceans and climate issues was first spawned at the first-ever United Nations Ocean conference co-hosted by Fiji and Sweden in 2017 to help provide a key focus to maintaining the health of our oceans and seas as well as to promote the 2030 sustainable agenda, especially related to SDG 14 Life Below Water. In the very same year, at the 23rd Conference of Parties (COP 23), and under Fiji's Presidency, this partnership gave rise to the successful launch of the Ocean Pathway Partnership (OPP) initiative. The OPP was founded with a two-pathway strategy for 2020 supporting the goals of the Paris Agreement that includes:

- Integrating oceans into the United Nations Framework Convention on Climate Change (UNFCCC) process through, inter alia, the possibilities of a UNFCCC agenda item and a work programme by 2019 and;
- Significantly increasing action in priority areas to ensure inclusion of oceans in Nationally Determined Contributions (NDCs) and other key ocean and climate linkages.

This partnership additionally gave rise to the formation of a network of like-minded organizations and parties called the "Friends of the Ocean and Climate." The governments of Sweden and Fiji launched the group, and a range of countries and non-government entities, such as Because the Ocean, the Global Ocean Forum, and Ocean Conservancy, participated in its activities. The purpose of this association was to initiate a dedicated discussion to ocean-inclusive dialogues within the UNFCCC to help maintain a healthy ocean, including sustainable fish stocks and well managed marine ecosystems.

This work has resulted in an emerging consensus on a systematic approach entailing more study and assess-

ment within bodies of the UNFCCC. Indonesia, Fiji, and Costa Rica have taken the lead in creating a draft COP decision that requests the SBSTA to convene a dialogue on ocean-climate issues and on the best institutional arrangement(s) during the June 2020 intercessional meeting in Bonn, solicits views from Parties and stakeholders, and requests the SBSTA to report back to the COP for consideration at COP26. In this way, the parties would create a process at COP25 that creates a space for the ocean that the Parties could adopt at COP26.

The Central Role of Nationally Determined Contributions: Developments in 2019

With the first cycle of revised NDC submissions starting in 2020, the past year has seen Parties preparing their respective NDCs, which are due for submission to the Secretariat of the UNFCCC by March 2020, with a view to their launch at COP26 at the end of 2020. Within this context, the incorporation of possible ocean elements within NDCs has increasingly become part of the conversation.

The Because the Ocean initiative organized a series of workshops, beginning at COP23 in Bonn in 2017, including regional workshops in Latin America (Santiago, Chile, October 2018), Europe (Madrid, Spain, April 2019) and the Pacific (Suva, Fiji, May 2019) in order to explore what ocean-related measures could be incorporated within NDCs.

A synthesis document released at the beginning of October 2019 provides a menu of options. The following five key actions are discussed in the report: (1) encouraging natural carbon sequestration by coastal ecosystems; (2) developing a range of sustainable ocean-based renewable energy solutions; (3) promoting adaptation and resilience solutions for vulnerable populations, ecosystems and ecosystem services threatened by climate change; (4) implementing hybrid solutions supporting both adaptation and mitigation in the fisheries and aquaculture sector; and (5) solutions in the shipping sector.

Parties are currently preparing the submission of their NDCs in 2020 as part of the next five-year ambition cycle. Therefore, it is early to assess how the ocean will be incorporated. Given that the analysis of ocean inclusion in NDCs has spurred attention to this issue, additional research on ocean inclusion in Adaptation Communications, NAPs, or Transparency reports would be a valuable area of science-policy research.

An online platform dedicated to Ocean Solutions during COP25 in Santiago will remain open throughout the intersessional period leading to COP26, in order to encourage ocean action within NDCs, and also within National Adaptation Plans, Adaptation Communications and other relevant national policy frameworks.

Development on the Oceans and Climate Nexus Related to Mitigation

Blue Carbon

The conservation, protection and restoration of forests, wetlands, and grasslands could provide a third of the global emissions reduction solution by 2030 that are needed to meet the long-term goals of the Paris Agreement.

As the IPCC Special Report on Oceans and the Cryosphere in a Changing Climate (SROCC) concluded, coastal blue carbon can contribute to mitigation for many nations but its global scope is modest (offset of < 2 percent of current emissions). However, for some countries such as Indonesia, Mexico or Australia with large areas of mangroves, including blue carbon to the mitigation section of their NDCs represents a significant opportunity to refine the scope and targets. This would demonstrate enhanced ambition on mitigation efforts while noting the additional adaptation and resilience benefits.

Despite the contribution of 30 percent of nature-based solutions (NbS) (all ecosystems) to climate mitigation to stay below 1.5°C, NbS only receives 2 percent of the funding.

From a conservation project point of view, successful projects are being upscaled, and new ones are emerging. While the demand for voluntary carbon credits from coastal blue carbon ecosystems seems ever increasing, only a modest amount of actual offset projects exists.

A Fall 2019 meeting of the International Blue Carbon Scientific Working Group of the Blue Carbon Initiative resulted in several major outcomes: First, a Nordic Blue Carbon network was formed, and the group adopted a six-month plan of activities in order to build on the momentum of the meeting. Second, at least two scientific papers are being drafted based on collaborations at the meeting: a review of the information available on Nordic blue carbon ecosystems, and a paper on the mitigation potential of macroalgae and macroalgal farming.

By including blue carbon ecosystems in climate action plans, including NDCs and other strategies, countries can demonstrate their commitment to solving the climate crisis that benefits the climate as well as communities and the environment.

Shipping Emissions

Around 80 percent of global trade by volume is carried by sea, and international seaborne trade has been constantly growing for the last decades, reaching 10.7 billion tonnes in 2017. Carbon dioxide emissions from international shipping were estimated (2012) to be 2.2 percent of global anthropogenic emissions.

For the first time, IMO envisages a reduction of the total annual GHG emissions from international shipping by at

least 50 percent by 2050 compared to 2008, while, at the same time, pursuing efforts towards phasing them out as called for in the vision, for achieving CO2 emissions reduction consistent with the Paris Agreement goals.

Since COP24, IMO progressed the implementation of its Initial GHG Strategy, with achievements such as approval 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, and initiation of the Fourth IMO GHG Study expected in 2020, to name a few.

Several important shipping private stakeholders have built on the political momentum generated by the adoption of the Initial IMO GHG Strategy. During COP24, shipping giant Maersk announced that they would target carbon neutrality by 2050. In June 2019, several major shipping banks with a combined shipping loan portfolio of USD 100bn – roughly 20 percent of the global total – have signed the "Poseidon Principles" whereby they commit to align their shipping credit products with the IMO GHG Strategy.

In 2019, IMO launched a project resulting from the cooperation between IMO and Norway (GreenVoyage2050) to focus on testing technical solutions to reduce GHG emissions from ships and established a new trust fund aiming at providing a dedicated source of financial support for technical cooperation and capacity-building activities to support the implementation of the Initial IMO GHG Strategy.

Offshore Renewables

In addition to more traditional renewable projects like wind and solar farms, researchers are investigating the potential of algal products with respect to carbon sequestration and biofuel, wave and tidal energies for coastal energy production, and floating solar panels in land-scarce regions like SIDS. Steady progress comes with the meeting of experts at conferences, dissemination of guiding publications, capacity building for high-potential areas, and deployment of innovative projects.

With funding from the Abu Dhabi Fund for Development, IRENA inaugurated a 10 MW solar PV project in Cuba in June 2019. IRENA also published a report in September 2019 titled "Navigating the Way to a Renewable Future: Solutions to Decarbonise Shipping."

Danish energy firm Orsted has made continued progress on the Hornsea One project, which will become the world's largest offshore wind farm upon completion in 2020. Located off England's Yorkshire coast, the project will power up to 1 million homes.

Carbon Capture and Storage

The international treaty regime made up of the London Protocol and London Convention (LP/LC) provides a global, transparent control and regulatory mechanism for protecting the marine environment from all sources of pollution. In 2009, Parties to the LP agreed an amendment to allow sub-seabed geological formations for sequestration projects to be shared across national boundaries–effectively allowing CO2 streams to be exported for CCS purposes. The CO2 export amendment to the LP is not yet in force. It needs to be formally accepted by two-thirds of the Contracting Parties to the LP, and will come into force globally just 60 days later.

The EU has committed EUR 10 million to establish, in cooperation with IMO, a global network of Maritime Technology Cooperation Centres in five regions: Africa, Asia, the Caribbean, Latin America and the Pacific. The objective is to help countries improve the efficiency of shipping, and thus limit and reduce greenhouse gas emissions from their shipping sectors, through technical assistance and capacity building.

EUR 20 million will be invested within the final calls of Horizon 2020 (the EU framework program for research and innovation) to support the decarbonisation of long distance shipping.

Development on the Oceans and Climate Nexus Related to Adaptation

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. Reaching a category five, Dorian became the fifth Atlantic hurricane of this strength seen in the last four years. Just weeks before Dorian hit the coast of the Bahamas, 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. 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. 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.

Low-lying SIDS face catastrophic impacts, facing the prospect of complete submergence, and in the most extreme cases, the necessity of evacuating their entire population to another country. 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. 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. Additionally, SIDS are facing significant coral reef loss, with 50 percent of coral reefs in the Pacific region under threat. Coral Reefs reduce the cost of global storm damage by USD 4 billion annually.

Vulnerable communities are facing the threat of relocation around the world. In Bangladesh, for example, 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. According to the World Bank´s March 2018 Report, climate change could become the country's number one driver of internal migration by 2050, displacing up to 13.3 million people. 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. A 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.

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. Investing in climate change adaptation efforts has become even more popular in recent years, 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. Following the report, the World Bank, the Bill and Melinda Gates Foundation, and several governments pledged USD 790 million to increase food security and agricultural resilience around the world. The United Nations Development Programme (UNDP) is also scaling up its support to climate actions across the globe through its 'Climate Promise' Program. This includes USD 3 billion in funding for climate action in over 100 countries in the next decade. Furthermore, in the beginning of 2019 the European Union also pledged EUR 30.7 billion towards strengthening disaster risk management in the Caribbean.

A recent report from Because the Ocean highlights 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. 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 Subsidiary Body for Scientific and Technological Advice (SBSTA) and lays out gaps and good practices regarding adaptation. Work will be continued on the scoping paper at COP25 in December 2019.

The SROCC stresses the importance of adaptation and claims that the integration of local and indigenous knowledge in adaptation efforts have been beneficial, and 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.

The clear message from the 1.5ºC and the 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 in surviving the new climate regime into which the world has moved.

The SROCC report singles out the fisheries and aquaculture sector as one of the human activities exposed and vulnerable to climate drivers and analyses impacts and responses. The report refers to the increased risk of harmful algal bloom (HAB) proliferation in coastal ecosystems and in estuaries in particular, that deep sea oceans are also experiencing an increase in temperature and a decrease in oxygen and pH, and that the combined effects of climate stressors are expected to shape the maximum fish catch potential, alter trophic relationships as well as the resulting relative abundance of large-sized fish (predators) versus small-sized fish (forage fish). The report also notes that actual (realized) catches in the 21st century will depend on fishing practices and fisheries governance much more than on climate change impacts alone. The redistribution of fisheries resources in response to direct and indirect effects of climate change have the potential to have governance implications. In some Western and Central Pacific island states, small-scale fisheries harvests are projected to decrease by 20 to 50 percent by 2050 (RCP 2.6 and 8.5) and overall, economic implications of climate change on fisheries is negative in countries with low Human Development Index and is projected to be higher for tropical countries. Adaptation strategies must include institutional and management adaptations, measures addressing livelihoods, and measures intended to manage and mitigate risks and thereby strengthen resilience. Adaptation solutions need political commitment, stakeholder participation, technological innovation and behavioral change to succeed.

Developments Related to the Low Carbon Blue Economy

The concept of the Blue Economy has been developing since its inception at the Rio+20 Conference in 2012. While some consider the Blue Economy to include any marine-adjacent industry, most parties have settled on a definition that calls for sustainable, responsible, low-carbon industries and policies that develop economic opportunities to reduce poverty and promote growth. Therefore, an example of a Blue Economy transition would include offshore renewable energy deployment, but not offshore oil and gas extraction. In 2019, initiatives along this line focused on 1) advancing the development of marine renewable energy (US Department of Energy report on "Powering the Blue Economy: Exploiting Opportunities for Marine Renewable Energy in Maritime Markets); and 2) addressing potential threats and dangers to the blue economy sector from climate change and environmental challenges and increasing climate resilience through Blue Economy (two policy dialogues on Blue Economy and climate change in the context of sustainable development held in the Seychelles and Namibia). Notable commitments made by States and civil society during the 2019 Our Ocean Conference include the European Commission pledge of $82.5 million towards companies that contribute to lowering carbon emissions, building the circular economy and promoting ecosystem conservation and the Ocean Foundation commitment of $6.8 million towards promoting a climate-resilient, sustainable Blue Economy in Latin America and the wider Caribbean Region.

Developments Related to Population Displacement

One of the key findings of the SROCC was the revised projection of the global sea level rise as a result of human-caused greenhouse gas emissions in the coming centuries, with predicted sea-level rise of about 84cm by 2100, and an upper estimate of the likely range of 1.1m. As a result of climate change, coastal populations will be significantly affected by increased extreme sea level events, extreme weather events, coastal erosion, and shifts in fish distribution and decreases in their abundance and related losses in income and food security, among other impacts.

The International Organization for Migration (IOM) Global Migration Indicators 2018 report shows that 68.5 million individuals were forcibly displaced worldwide due to persecution, conflict, generalized violence, human rights violations or other reasons by the end of 2017, with 258 million international migrants counted globally in 2017, representing 3.4 percent of the world's total population. In coastal areas, according to IPCC Fifth Assessment Report (AR5) sea level rise scenarios, without considering the potential benefits of adaptation, it is estimated that globally about 6,000 to 17,000 km2 of land is expected to be lost during the 21st century due to enhanced coastal erosion associated with sea level rise in combination with other drivers. It is estimated that a displacement of 1.6 to 5.3 million people will be caused and associated cumulative costs is likely to be USD 300 to 1000 billion.

Though it might be difficult to address displacement linked to individual events such as tropical storms and high tide flooding under existing coordinating mechanisms, such as the UNFCCC Task Force on Displacement, there is an increasing number of studies linking individual extreme weather events to climate change as highlighted in the SROCC. Slow-onset events like saltwater intrusion and loss of land due to sea level rise are more easily attributable to climate change and are easier to include in long-term loss and damage discussions. Future research priorities include migration predictions, in particular of international migration and analysis on different migration outcome and its causes as well as case studies on the specific impact of disasters and peoples' response.

The Global Report on Internal Displacement 2018 cites that 61 percent of new internal displacements were triggered by disasters, highlighting the need for investment at the national and international levels in sustainable development, peacebuilding, addressing the impacts of climate change and disaster risk reduction.

IOM has over 150 publications available on climate change as it links to displacement and migration. A new 2019 publication on climate change and migration in vulnerable countries, including SIDS, highlights environmental migration and its link to the ocean.

In September 2016, the United Nation General Assembly adopted the New York Declaration for Refugees and Migrants, which in 2018 adopted the Global Compact for Safe, Orderly and Regular Migration (GCM). The resolution plans for the third High-level Dialogue on International Migration and Development, to be held in New York, no later than 2019 to 2020, with a role envisaged for the High-level Dialogue in the process.

In the 20-year period from 1998 to 2017, the cost associated with climate change related disasters has skyrocketed to USD 2.25 trillion according to a United Nations Office for Disaster Risk Report, and global action that will need to take place to ward off a worst case scenario that could see climate impacts displacing as many as 140 million people within their own borders by 2050 according to a report released from the World Bank Group, Groundswell: Preparing for Internal Climate Migration.

Out of 193 countries and territories having submitted INDCs, 20 percent refer to human mobility. National policies are being enhanced on human mobility dimension, however, related financing still relatively weak. There is no explicit guidance on human mobility within the Green Climate Fund (GCF), however, there are currently 21 GCF projects with human mobility elements included, which were developed based on respective national policies.

The Executive Committee of the Warsaw International Mechanism for Loss and Damage hosts the Task Force on Displacement, the primary discussion place to consider climate-related migration and displacement issues within the UNFCCC. The Task Force adopted recommendations by states parties to the UNFCCC in Decision 10/CP.24, firmly anchoring migration and displacement issues in the official work programme of the UNFCCC. In parallel, the UNFCCC, through the regular work programme of the Executive Committee of the Warsaw International Mechanism (Excom/WIM), is engaged in an intensive programme of work pertaining to climate change and migration. The Excom held two meetings in 2019, focused on work related to slow onset events and the scope of an upcoming policy brief, in addition to sources of financial support, among other topics.

At COP24, one event organized by IOM and PDD on behalf of the Wim/Excom, presented the recommendations of the Task Force on Displacement to the COP attendees. At Oceans Action Day, an adaptation and population displacement panel discussed the importance of preparedness, and it was noted that displacement is about adaptation, mitigation, loss and damage, and finance and capacity development.

The International Law and Sea Level Rise Committee, which was established by the International Law Association Executive Council in 2012, produced a 2018 Report highlighting 12 principles with commentary comprising a "Declaration of Principles on the Protection of Persons Displaced in the Context of Sea Level Rise," and a second report that was considered at the seventy-third session of the UNGA Six Committee's International Law Commission. The 2018 Sydney Declaration highlighted the Principles which apply to all forms of human mobility arising in the context of sea level rise, calling for primary duty and responsibility of States to protect and assist affected persons.

Research indicates that ambitious mitigation of warming can greatly reduce the risk of large-scale displacement, while also indicating that a certain amount of displacement is inevitable even if emissions are peaked as soon as 2010. It is imperative that the international community work together on a proactive, comprehensive and coordinated response.

Developments Related to Financing on Oceans and Climate

Scholars have begun and will continue to study ocean financing needs and mechanisms, particularly as part of the efforts to track progress toward meeting the targets for SDG14. To contribute to efforts to track public financing of ocean conservation and climate action, a baseline has been established for three international institutions operating at the global level: the Global Environment Facility (GEF), the Green Climate Fund (GCF) and the World Bank. Total public financing (or aid) from the GCF, GEF and World Bank to support ocean conservation and climate action increased from just over USD 500 million in 2013, to over USD 2 billion in 2017. The funding largely targeted SDG 13.1 (coastal population adaptation), followed by SDG 14.2 (ecosystem management) and 14.4 (fisheries).

Regarding support to SIDS for ocean conservation, 56 projects (35 percent of total) targeted SIDS, for a total funding of USD 482.7 million. Also, 57 percent of funding aimed to help coastal populations adapt to climate-related impacts.

The need for a comprehensive ocean finance approach and the idea of developing and scaling innovative financing is gaining traction, and is receiving support from a number of sources, including the World Bank ProBlue program and a number of specific examples of innovative ocean finance were implemented in 2019:

- -- the first larger blue bond launch in the form of the Nordic Investment Bank' Baltic blue bond
- -- a Shipping Technical Working Group and Industry Working Group to discuss and develop the Shipping Criteria convening under the Climate Bonds initiative
- -- the publication of "Blue Bonds: Financing Resilience of Coastal Ecosystems: Key Points for Enhancing Finance Action: A technical guideline prepared for IUCN GMPP
- -- the launch of the "Blue Bonds for Conservation Initiative" by the Nature Conservancy
- -- a potential Pacific Ocean Bond

The G7 under the Canadian Presidency in the Charlevoix Blueprint for Healthy Oceans, Seas and Resilient Coastal Communities supported innovative financing for coastal resilience, followed by the commitment at the Biarritz summit in 2019 to support the Ocean Risk and Resilience Action Alliance.

Resilience bonds emerged in 2019, with The European Bank for Reconstruction and Development (EBRD) issuing September 2019 what the first bond issued to exclusively finance climate resiliency projects. It raised

USD 700 million for a yield of 1.737 to 9.2 percent basis points over the five-year Treasury.

Multilateral development banks are increasingly focusing on the oceans and climate nexus through dedicated ocean efforts such as the Asian Development Bank's Action Plan for Healthy Oceans and Sustainable Blue Economies' for Asia and the Pacific alongside an ADB Oceans Financing Initiative.

Further opportunities for innovative ocean Public-private Partnership (PPP) funding arise from progress in ocean observation and remote sensing and data technologies. Ocean plastics have attracted innovative financial sources from both public and private sources. Traditional conservation efforts through MPAs and reef management are increasingly being considered for innovative finance options.

Asset managers are increasingly challenging their investee companies to confirm their sustainability intentions, which should in time focus investment flows into sustainable green and blue deals, and with other avenues of innovative finance on the rise, ocean finance innovation is well aligned with broader trends in financial innovation. The large infrastructure finance needs in the coastal space in particular require rapid scaling of innovative finance with significant private sector engagement if the ocean-climate nexus is to be appropriately addressed.

Developments Related to Capacity Development

There have been many investments in education and science and competencies related to the oceans and climate change and SDGs outside the convention process. There are many excellent ocean and climate professionals and institutions in developing countries and these should continue to be supported. Further, these should be supported to further incorporate climate change issues with an aim of helping communities and countries meet the Paris Agreement objectives.

In terms of climate change and the ocean and coastal communities, capacity-building efforts supported by the Convention are still in their infancy. If the global community hopes to stabilize at 1.5 C, efforts on oceans and climate change in terms of capacity-building must be systematically strengthened and be focused on embedding new capacity-building into national and regional institutions and enhancing pre-existing academic programs to better address climate and oceans educational gaps. The UN Secretary General's Climate Action Summit, 23 September 2019, New York, which aimed to increase ambition and accelerate action to implement the Paris Agreement, focused on nine interdependent tracks, among which is Nature-based Solutions. Nature-based Solutions will focus on forests and land-based ecosystems, smart agriculture and food systems, regeneration of life in rivers, lakes and oceans, and enabling connections among all people and nature for which capacity needs to be developed at various levels.

Prospects for Addressing the Oceans and Climate Nexus at COP25

Given the unexpected shift of venue from Santiago, Chile to Madrid, Spain, planning for COP25 has proven challenging for many Parties and stakeholders. Nevertheless, thanks to the indefatigable efforts by both the Government of Chile (as the COP Presidency) and the Government of Spain which is providing the hosting and logistical support for the summit, COP25 is poised for success.

Dubbed the "Blue COP" early on in the year, COP25 is attracting much attention and action by state Parties and civil society alike. The Oceans Action Day on December 6 and 7, 2019, will assess existing ocean and climate action and identify the gaps that need to be addressed, focusing, in particular on the policy implications of the IPCC SROCC report and the 1.5°C report. With the extensive support of civil society, Parties will be considering options for further accelerating the consideration of oceans and coastal zones issues within the UNFCCC.

The number of ocean-related side events taking place at COP25, in national pavilions and in every type of venue at the COP represents a new all-time high for UNFCCC COPs, including 86 events addressing both the science and policy aspects of the wide variety of issues involved in the oceans and climate interface.

In effect, the awareness and support for heightening the focus on oceans and climate both within and outside the UNFCCC is unprecedented. The scientists have spoken loudly and clearly in the two IPCC reports. The young people have spoken and have said "do not rob of us of our future." Political Leaders on every continent have stressed the importance of the oceans and climate action and the need for ambitious and concerted action.

Therefore, we very much hope that the COP25 will indeed turn out to truly be a "Blue COP" and significantly accelerate movement on oceans and climate issues within the UNFCCC. While there has been incremental progress in various bodies and processes of the UNFCCC on the oceans and climate nexus, these measures do not yet correspondence to the magnitude and importance (environmental, social, and economic) of the oceans and climate interface. The time for ambitious action is now, not tomorrow.

1. INTRODUCTION

1.1 Purpose of the Progress Report

The Roadmap to Ocean and Climate Action (ROCA) Initiative is pleased to present this summary of major developments in ocean and climate science, policy, and action in 2019. Each section reviews the recommendations from the *Strategic Action Roadmap to Ocean and Climate Action: 2016-2021* and provides examples of action or other developments relevant to that action area. This report describes the worrying negative impacts of climate change on ocean ecosystems and coastal and island populations, which have accelerated significantly in recent years. Though a great deal of political momentum and public awareness around the relationship between climate and ocean has been mobilized in recent years, the overall picture reveals a need for more urgent action and investment in mitigation and adaptation to protect marine environments and the human populations which depend on them. The ocean and climate issues described below should be addressed at all levels of policy as an inter-related "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); 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.

The *Strategic Action Roadmap on Oceans and Climate: 2016 to 2021,* first discussed at COP 21 in Paris in 2015 and then presented at COP 22 in Marrakech in 2016, was written as a proposed five-year vision for action regarding oceans and climate policy.[2] The central assertion of the Strategic Action Roadmap to Ocean and Climate Action: 2016-2021 is that the impacts of climate change on ocean ecosystems and coastal and island populations should be considered both within the UNFCCC and at all levels of policymaking related to climate change and ocean management, both for the survival of planetary health and for human well-being. The ocean plays a key role in regulating the climate, producing 50% of the oxygen on Earth, storing 50% of all carbon naturally sequestered from the atmosphere, and absorbing 30% of the anthropogenic heat added since the 1970s.[3] In turn, changes in the climate have significant impacts on the ocean, including but not limited to warming, changes in ocean chemistry, deoxygenation, sea level rise, and changes to ocean circulation patterns. These impacts have the potential to drastically disrupt human activities in coastal and island areas; particularly those that rely on fisheries, aquaculture, stable coastlines, and coastal tourism for their livelihoods.

ROCA is dedicated to supporting the implementation of the policy recommendations in the Roadmap, by, inter alia; developing specific targets, indicators, and timetables; tracking policy changes and new pathways, particularly in the UNFCCC, and reporting these at each Conference of Parties (COPs) yearly;[4] working with national and local level leaders to implement specific actions furthering the Roadmap goals; tracking public climate financing towards oceans; and developing recommendations on how to support ocean-based mitigation and adaptation goals in Nationally Determined Contributions (NDCs), particularly those of Small Island Developing States (SIDS).

Readers are kindly invited to contact the authors with comments and contributions on the 2019 Report.

Major Topics Addressed in the Report

In the following sections, this Progress Report for 2019 addresses progress (or lack thereof) in the following categories:
2. The central role of oceans in climate and associate science and policy issues, covering new scientific findings and their policy implications; 3. The central role of Nationally Determined Contributions; 4. Mitigation (including Blue Carbon, curbing air emissions from ships, renewable energy, and carbon capture and storage); 5. Adaptation; 6. Low carbon Blue Economy; 7. Population Displacement; 8. Financing on Oceans and Climate; and 9. Capacity Development.

1.2 Outcomes of COP24, Overview of Oceans and Coasts at COP24

Following the October 2018 release of the IPCC Special Report on Global Warming of 1.5˚C, COP24 convened in Katowice, Poland from 2-15 December 2018. The main purpose of the meeting was to complete work on the Paris Agreement Work Programme (PAWP), a set of decisions meant to operationalize the Paris Agreement by

2 Full text of the Roadmap: http://bit.ly/2hzqvyV & Summary of Roadmap (http://bit.ly/2xHc1Ct)

3 IPCC. (2013). "Technical summary," in Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change, T. F. Stocker et al., Eds. (Cambridge Univ. Press, Cambridge, 2013), pp. 33–115. and IPCC. (2014) "Summary for policymakers," in Climate Change 2014: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change, C. B. Field et al., Eds. (Cambridge Univ. Press, Cambridge, 2014), pp. 1–32. and Gattuso J.P. et al. (2015). Contrasting Futures for Ocean and Society from Different Anthropogenic CO2 Emissions Scenarios. Science. 329(6253).

4 The first Progress Report Assessing Progress on Ocean and Climate Action: 2016-2017 was prepared for and presented at COP 23 in Bonn, Germany; the second Progress Report "Assessing Progress on Ocean and Climate Action 2018" was prepared for and presented at COP 24 in Katowice, Poland (available on the ROCA website https://roca-initiative.com/).

turning the Paris Agreement's broad commitments into the detailed technical guidance needed to measure mitigation, account for finance, and to ensure transparency. [5]

The Katowice Climate Change Conference produced a package that facilitates countries' efforts to implement the agreement, with parties adopting the Katowice Climate Package, including decisions on most issues mandated as a part of PAWP, including mitigation, adaptation, finance, technology, transparency framework, the global stocktake, and the committee to facilitate implementation and promote compliance. Even with an extra negotiating session in Bangkok in September 2018, a resolution was needed on 236 pages of text at the start of COP24.

COP24 delivered the Katowice Climate Package, 97 pages of operational guidelines that represent both legally- binding language as well as prescriptive guidance. The Katowice Climate Package can be expected to deliver ambition in four ways: By resolving politically difficult issues, balancing the need for binding and prescriptive guidance with the need for flexibility, enabling a dynamic agreement through both collective and individual review mechanism and timelines for revisiting guidelines, and addressing all issues now as opposed to waiting for future negotiations.

Differentiation and finance are regarded as the two most contentious issues discussed at COP24. In the package developed in Katowice, mitigation-centric NDC guidance are balanced with improved financial processes for developing countries. Developing countries prevailed in their call for a clear process to assess and review developed countries' indicative finance provision reports, initiating in 2020 deliberations on setting the new collective quantified finance goal for the post-2025 period, as well as a decision on the Adaptation Fund, which will now serve the Paris Agreement.

The transparency framework, a core component of the 'ambition mechanism' in the Paris Agreement now includes detailed guidance on countries' reporting, with parties submitting transparency reports every two years, with a requirement to submit the first report by 2024, while giving flexibility to vulnerable countries such as LDCs and SIDS in terms of how and when they apply the guidance. The Katowice Climate Package enhanced the implementation and compliance committee, which can now initiate consideration of non-compliance in certain cases. The Package also sets timeframes for review and revision of the guidance in several sections. The most important outcome of the negotiations is that parties were able to agree to most elements in the PAWP, with the exception of guidance for international transfers of mitigation outcomes, rules for the Agreement's carbon offsetting mechanism, and a work programme for non-market based approaches.

While the Katowice Climate Package delivered on its mandate, there were components that fell short. The Package merely "takes note" of the Talanoa Dialogue process, with fewer announcements of new climate finance. An additional component of the 'ambition mechanism,' the global stocktake, which takes stock of collective progress, left non-party stakeholders and developing countries discouraged, with apparent inequity. The second week of negotiations was not open to non-party stakeholders, who are crucial to raising ambition. There was also diminished focus on the Global Climate Action Agenda. Additionally, Saudi Arabia, United States, Russia, and Kuwait resisted the welcoming of the IPCC Special Report on 1.5°C, taking note of the report and the importance of stopping global warming above 1.5°C. Developing countries felt that the issue of loss and damage was again sidelined.

5 This summary relies on the Bulletin and IISD Reporting Services Conference Coverage of the Katowice Climate Change Conference (COP24)—December 2018 (http://enb.iisd.org/climate/cop24/enb/)

Despite these shortfalls, delegates left Poland feeling 'cautiously uplifted,' according to IISD reporting. Moving toward 2019, increased implementation and ambition are needed globally to build on the progress made at COP 24 through the Katowice Climate Package.

Oceans Action Day at COP24 Katowice Poland

Midway through COP24 and in the association with the Marrakech Partnership for Global Climate Action, Oceans Action Day was held on 8 December 2018, hosting over 50 speakers and 400 participants. The event featured the UN Secretary General's Special Envoy for the Ocean, Peter Thomson, as well as ambassadors, ministers, and high-level representatives from governments and civil society. [6]

The key outcome of the event was a greater commitment to include the oceans and climate nexus on the UNFCCC agenda and the climate change negotiations, with many high-level delegates underscoring the importance of concurrently addressing threats to the ocean and the impacts of climate change on human populations and ecosystems in 183 coastal and island nations.

The Oceans Action Day at COP24 addressed many impacts and high-impact levers, starting with the IPCC Special Report on Global Warming of 1.5°C, a landmark report with far reaching implications for all climate change action and with special relevance to oceans and coasts. Commitments to SDG 14 and the formation of a robust Paris Agreement Work Programme, taking into account the ocean and coasts, in Katowice were also discussed as a part of the Marrakech Partnership Ocean and Coastal Zones Action Event.

The Oceans Action Day at COP24 framed the policy discussions in the context of new relevant scientific evidence, particularly in reference to the IPCC report on 1.5°C.[7] As readers will recall, the request to IPCC to carry out this report was a key outcome of COP 21 in Paris, following the SIDS nations long-standing push for "1.5°C to stay alive." The 1.5°C report is a landmark report with far reaching implications for all climate change action and with special relevance to oceans and coasts. The report:

-- ***Demonstrates that the predicted impacts of climate change are coming much earlier than expected—***we will most likely reach a warming of 1.5°C as early as 2030 and no later than 2052, posing immediate threats to peoples and ecosystems around the world, especially in 183 coastal countries and SIDS. Global emissions of greenhouse gases have to approach zero already in 2050 to avoid the most harmful consequences. As noted by Panmao Zhai, Co-Chair of IPCC Working Group I, *"One of the key messages that comes out very strongly from this report is that we are already seeing the consequences of 1°C of global warming through more extreme weather, rising sea levels and diminishing Arctic sea ice, among other changes."*

-- ***Demonstrates that there is a marked difference between keeping to a 1.5°scenario versus a 2.0 scenario—***under a 1.5°C scenario, displacement of millions of people due to sea level rise, increased frequency and intensity of storms, and other seriously adverse effects may be avoided. Limiting warming to 1.5°C instead of 2°C would reduce the impacts of rising sea levels, lower the likelihood of an ice-free Arctic in summer, and limit coral-reef decline alongside many other negative consequences of increased temperatures.[8] As noted by Hans-Otto Pörtner, Co-Chair of IPCC Working Group II, *"Every extra bit of warming matters, especially since warming of 1.5°C or higher increases the risk associated with long-lasting or irreversible changes, such as the loss of some ecosystems..... Limiting global warming would also give people and ecosystems more room to adapt and remain below relevant risk thresholds."*

-- ***Finds that limiting global warming to 1.5°C would require "rapid and far-reaching" transitions in land, energy, industry, buildings, transport, and cities.*** Global net human-caused emissions of carbon dioxide (CO_2) would need to fall by about 45 percent from 2010 levels by 2030, reaching 'net zero' around 2050. This means that any remaining emissions would need to be balanced by removing CO_2 from the air. As Jim Skea, Co-Chair of IPCC Working Group III noted, *"Limiting warming to 1.5°C is possible within the laws of chemistry and physics but doing so would require unprecedented changes."*

Initiatives discussed at the Oceans Action Event included the Global Coral Reef Partnership, a successful example of increasing action in priority areas of ocean and coastal

6 For summaries of the Oceans Action Day at COP24, see Oceans Action Day at COP 24 Bulletin and IISD Reporting Services Conference Coverage (https://bit.ly/2Mf6Zmt)

7 IPCC, 2018: Summary for Policymakers. In: Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty [Masson-Delmotte, V., P. Zhai, H.-O. Pörtner, D. Roberts, J. Skea, P.R. Shukla, A. Pirani, W. Moufouma-Okia, C. Péan, R. Pidcock, S. Connors, J.B.R. Matthews, Y. Chen, X. Zhou, M.I. Gomis, E. Lonnoy, T. Maycock, M. Tignor, and T. Waterfield (eds.)]. In Press.

IPCC, 2019: Summary for Policymakers. In: IPCC Special Report on the Ocean and Cryosphere in a Changing Climate[H.-O. Pörtner, D.C.Roberts, V. Masson-Delmotte, P. Zhai, M. Tignor, E. Poloczanska, K. Mintenbeck, M. Nicolai, A. Okem, J. Petzold, B. Rama, N. Weyer (eds.)]. In press.

8 For instance, by 2100, global sea level rise would be 10 cm lower with global warming of 1.5°C compared with 2°C. The likelihood of an Arctic Ocean free of sea ice in summer would be once per century with global warming of 1.5°C, compared with at least once per decade with 2°C. Coral reefs would decline by 70-90 percent with global warming of 1.5°C, whereas virtually all (> 99 percent) would be lost with 2°C.

zones, and a call to begin funding for an ocean prediction system through IOC/UNESCO, which would work through modelling, an ocean observation system, and predictive ecosystem management. GOF unveiled the 2018 Progress Report on Oceans and Climate, *Assessing Progress on Ocean and Climate Action: 2018*.[9] FAO presented a landmark report on *Impacts of Climate Change on Fisheries and Aquaculture*,[10] a synthesis of current knowledge, adaptation and mitigation options, featuring over 100 authors, of country-by-country assessments for analyzing the climate and marine fisheries nexus.

Additional panels, featured discussions on ocean acidification and sustainable development stressing the need for regionally tailored action and a robust coastal monitoring infrastructure; experts presented the newest scientific findings on the ocean and climate nexus and discussed implications of climate change on adaptation and population displacement, and ways of enhancing the ocean content of NDCs and ocean financing. Throughout the presentations, a particular emphasis was placed on incorporating the newest scientific findings, especially related to the IPCC 1.5°C report, into a realistic and effective policy framework.

The Oceans Action Day at COP24 concluded with summary reports on the major ocean and coastal zone themes being discussed at COP24, and the scientific, political, social, and economic implications for the future. The final panel included closing remarks from several high-level ambassadors and ministers, with a clear call to action to address, with urgency, the oceans and climate nexus within the UNFCCC process and in other global, regional, and national contexts.

1.3 Progress on the Ocean and Climate Nexus Within the UNFCCC[11]

The ocean is a part of the climate and a part of the UNFCCC. Under the UNFCCC, governments have agreed to prevent dangerous anthropogenic interference with the climate system, which is defined under the Convention as the totality of the atmosphere, hydrosphere, biosphere and geosphere and their interactions. In article 4.1, they committed to promote sustainable management, and promote and cooperate in the conservation and enhancement, as appropriate, of sinks and reservoirs of all greenhouse gases, including biomass, forests and oceans as well as other terrestrial, coastal and marine ecosystems.

The Cancun Agreement[12] recognised the need to strengthen international cooperation and expertise in order to understand and reduce loss and damage associated with the adverse effects of climate change, including impacts related to extreme weather events and slow onset events (including sea level rise, increasing temperatures, ocean acidification, glacial retreat and related impacts, salinization, land and forest degradation, loss of biodiversity, and desertification)

In the Paris Agreement, Parties have committed to limit global temperatures to well below 2 degrees C compared to pre-industrial levels, with the aim to limit to 1.5 degrees C. Commitment to this temperature goal and net zero under the Paris Agreement is a priority to protect the ocean and the services they provide. The ocean is an opportunity for action for mitigation and adaptation to build resilience and generate co-benefits, as well as in measuring collective progress in the global stocktake.

The Subsidiary Body for Scientific and Technological Advice (SBSTA) of the UNFCCC under the Research and Systematic observation agenda item[13] encourage Parties and relevant organizations to address and invest in systematic observation and research of the ocean and its role in the global climate system, including for the global energy balance and carbon cycle, and impacts related to, inter alia, ocean acidification, sea level rise and ecosystem services.[14] The Research Dialogue: Science for transformation, held on 20 June 2019 in conjunction with SBSTA 50, promoted discussion at the science–policy interface including on the role of the ocean in the climate system.[15] The Earth Information Day during SBSTA 51 (COP25) will present the state of the global climate, implementing Earth observation, including of the ocean, and observation support for decision making.

At SBSTA 50, the SBSTA mandated that the focus for the Nairobi Work Programme on impacts, vulnerability, and adaptation to climate change (NWP)[16] during 2019/2020 should be on oceans, coastal areas and ecosystems, including mega deltas, coral reefs and mangroves.[17] The NWP focal point forum at SBSTA 51 on this topic will be held on Friday 6 December 2019 and all stakeholders are invited to participate, as well as contribute to the range of activities to advance action in this area. Progress made will be reported to Parties for their consideration at SBSTA 52 (May/June 2020).

The 5 year work programme of the Warsaw International Mechanism on loss and damage (WIM)[18] includes

9 ROCA Report, Assessing Progress on Ocean and Climate Action: 2018 (https://bit.ly/2RBnOOA)

10 FAO Fisheries and Aquaculture Technical Paper, Impacts of Climate Change on Fisheries and Aquaculture: http://www.fao.org/3/I9705EN/i9705en.pdf

11 The authors of this Report are indebted to Joanna Post, UNFCCC focal point on oceans and coastal zones, for the preparation of this succinct summary of progress in UNFCCC action on the ocean and climate nexus.

12 Cancun Agreement Decision 1/CP.16

13 https://unfccc.int/topics/science/the-big-picture/science-in-the-negotiations

14 FCCC/SBSTA/2018/4, https://unfccc.int/documents/180332

15 https://unfccc.int/topics/science/workstreams/research/research-dialogue/eleventh-meeting-of-the-research-dialogue-science-for-transformation

16 http://unfccc.int/nwp

17 https://unfccc.int/documents/196713

18 https://unfccc.int/wim-excom

ocean issues, which are being considered under slow onset event, non-economic losses and irreversible impacts (e.g. coral bleaching). As part of this work, the Executive Committee of the WIM is working with the Technology Executive Committee (TEC) to prepare a policy brief on technology to avert, minimize and address loss and damage in coastal zones.[19] An expert dialogue was held on this topic at SBSTA 50.[20]

National Adaptation Plans (NAPs) continued to be submitted to the secretariat in 2019 and, to date, all NWPs include projects on ocean and coastal zone.[21]

Although revised and updated Nationally Determined Contributions are not due to be submitted until 2020, raised ambition is urgently needed. A number of countries have indicated that their outlook is for increased ambition, including in relation to action for ocean and coastal zones.[22]

Under the Marrakech Partnership for Global Climate Action, ocean and coastal zone are a key theme of the UNFCCC global climate action agenda. The Global Climate Action Platform has been redesigned in 2019[23] and for the first time the portal will bring together Party and non-Party data to show how, together, climate action is being advanced. To provide a complete and representative view of the global state of climate action, the secretariat is seeking further climate action commitments, including on ocean and coastal zones.

The Conference of the Parties (COP) has repeatedly expressed its appreciation for the IPCC's work and called on the Convention bodies, in particular the SBSTA, to continue its cooperation with the IPCC and to seek its advice. In continuation of this strong relationship, a joint SBSTA-IPCC special event: Special report on the Ocean and Cryosphere in a Changing Climate (SROCC) will be held at COP25 during SBSTA 51 on Thursday 5 December, 2019.

1.4 Progress on Ocean and Climate Issues at the Regional Level: Examples from the European Commission (EC) Context

The importance of the role the oceans can play in the implementation of the Paris Agreement was recognised, years ago, by the European Union through the adoption of a Joint Communication and Council conclusions on International Ocean Governance.[24] The Joint Communication commits the European Commission (EC) to propose international action to follow-up on the consequences, inter alia, of ocean warning, sea-level rise and acidification.

Building on the initiatives and achievements made in 2017 and 2018 (see previous Progress Reports), and at the invitation of the European Council,[25] the EC has, in 2019, advanced work "on the conditions, the incentives and the enabling framework to be put in place in order to ensure a transition to a climate-neutral EU (..) that will preserve European competitiveness, be just and socially balanced, take account of Member States' national circumstances and respect their right to decide on their own energy mix, while building on the measures already agreed to achieve the 2030 reduction target."

In October 2019, the EU Member States adopted a set of Council Conclusions on the preparations for CoP25[26]

19 FCCC/SB/2017/1/Add.1, FCCC/SB/2018/1

20 https://unfccc.int/topics/adaptation-and-resilience/workstreams/loss-and-damage-ld/workshops-meetings/expert-dialogue-on-technologies-for-averting-minimizing-and-addressing-loss-and-damage-in-coastal

21 https://www.unfccc.int/nap

22 For example see https://www.undp.org/content/undp/en/home/library-page/environment-energy/climate_change/ndc-global-outlook-report-2019.html

23 https://climateaction.unfccc.int/

24 Joint Communication "International ocean governance : An agenda for the future of the oceans" adopted on 10 November 2016, JOIN(2016)49

25 European Council Conclusions adopted on 20 June 2019, EUCO 9/19

26 Council Conclusions adopted on 04 October 2019, 12796/19

that supports the CoP25 priorities including attention to the ocean-climate nexus and welcomed the IPCC Special Report on the Ocean and the Cryosphere in a changing climate.

In October 2019, at "Our Ocean Conference" in Oslo, the EU announced 22 new ocean commitments, worth EUR 540 million including targeted action to support climate change adaptation in highly sensitive marine regions like the Pacific Islands and the Coral Triangle, advance climate monitoring and research, for example in the Arctic and the Antarctic, and promote the transition to a low carbon emission economy.

The ocean and climate nexus is eventually an integral part of the Council conclusions on the oceans that will be adopted in November 2019.[27] These conclusions call for increased policy action at all governance levels, stress that a full implementation of the Paris Agreement is the most important action to protect the oceans, especially through enhanced greenhouse mitigation action, and highlight the urgency of making global shipping more sustainable.

1.5 Progress with the Mobilization of UNFCCC Friends of the Ocean and Climate and Associated Actions

This section summarizes efforts by Parties, in collaboration with civil society, to advance the ocean and climate nexus within the UNFCCC, with emphasis on dicussions and actions taking place in 2019 and in planning for ocean action at COP25.

The Inaugural Ocean Pathway Partnership and Friends of the Ocean and Climate

The first-ever United Nations Ocean conference was co-hosted by Fiji and Sweden in 2017 to help provide a key focus to maintaining the health of our oceans and seas as well as to promote the 2030 sustainable agenda, especially related to SDG 14 Life Below Water.[28] In the very same year, at the 23rd Conference of Parties (COP 23), and under Fiji's Presidency, this partnership gave rise to the successful launch of the Ocean Pathway Partnership (OPP) initiative.[29] The OPP was founded with a two-pathway strategy for 2020 supporting the goals of the Paris Agreement that includes:

- Integrating oceans into the United Nations Framework Convention on Climate Change (UNFCCC) process through, inter alia, the possibilities of a UNFCCC agenda item and a work programme by 2019 and;
- Significantly increasing action in priority areas to ensure inclusion of oceans in Nationally Determined Contributions (NDCs) and other key ocean and climate linkages.[30]

This partnership additionally gave rise to the formation of a network of like-minded organizations and parties called the "Friends of the Ocean and Climate." The governments of Sweden and Fiji launched the group, and a range of countries and non-government entities, such as Because the Ocean, the Global Ocean Forum, and Ocean Conservancy, participated in its inaugural activities. The purpose of this association was to initiate a dedicated discussion to ocean inclusive dialogues within the UNFCCC to help maintain a healthy ocean, including sustainable fish stocks and well managed marine ecosystems.[31]

Since the launch of the OPP, many of the parties who have ratified the Paris Agreement have provided remarkable support in the buildup of the ocean momentum in this space. At COP 24 in Katowice, an initial stocktake of events was carried out to identify some of the missing linkages that were further affirmed by the Intergovernmental Panel on Climate Change (IPCC) special report of 1.5°C (SR 1.5) above pre-industrial levels and related global greenhouse gas emission pathways. As discussed earlier, the report highlights that ocean ecosystem services are decreasing rapidly (high confidence) with impacts of ocean acidification (medium confidence) and that, to maintain a healthy ecosystem service, global temperature rise should be limited to well below 1.5 °C to reduce risks to marine biodiversity, fisheries, and ecosystems, and their functions and services to humans[32] (high confidence).

While the decision to accept SR 1.5 could not be agreed upon by all Parties at COP 24 due to conflicting views amongst Parties, the findings and key issues remain the same and have been further emphasized by the release of the IPCC Special Report on the Ocean and Cryosphere in a Changing Climate (SROCC) in September 2019 (detailed in section 2 of the Progress Report). According to the SROCC, the global ocean has warmed persistently since 1970 and has taken up more than 90% of the excess heat in the climate system, with consequences now visible in increased ocean acidification, de-oxygenation

27 Council Conclusions adopted to be adopted on 19 November 2019.

28 United Nations (2017). Our oceans, our future. Partnering for the implementation of Sustainable Development Goal 14. Accessed on 8/10/2019 from: https://www.un.org/en/conf/ocean/

29 COP 23 Fiji (2017). The Ocean Pathway. Accessed on 8/10/2019 from https://cop23.com.fj/the- ocean-pathway/

30 Mead, L (2017). Ocean Pathway Launched at COP 23. International Institute for Sustainable Development. Accessed on 8/10/2019 from https://sdg.iisd.org/news/ocean-pathway-launched-at- cop-23/

31 COP 23 Fiji (2017). The Ocean Pathway. Accessed on 8/10/2019 from https://cop23.com.fj/the- ocean-pathway/

32 IPCC, 2018: Summary for Policymakers. In: Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty [Masson-Delmotte, V., P. Zhai, H.-O. Pörtner, D. Roberts, J. Skea, P.R. Shukla, A. Pirani, W. Moufouma-Okia, C. Péan, R. Pidcock, S. Connors, J.B.R. Matthews, Y. Chen, X. Zhou, M.I. Gomis, E. Lonnoy, T. Maycock, M. Tignor, and T. Waterfield (eds.)]. In Press.

and stratification.[33] The report underscores the urgency of prioritizing "timely, ambitious and coordinated action" to address "unprecedented" and enduring changes in the ocean and cryosphere.[34]

Advancement into 2019

In noting the objective(s) of the OPP, Fiji with Because the Ocean and the Secretariat of the Pacific Community hosted the Pacific NDC meeting in Suva, Fiji (May 2019) to highlight some of the domestic options in maintaining ocean governance such as engagements with marine mitigations measures (sustainable fisheries management and critically removing emissions from maritime-based transportation) and implementing the sustainable development agenda.[35]

Consequently, the Ocean and Climate Negotiators' Forum co-hosted by Chile, Fiji, Norway, and Sweden in Suva, Fiji (May 2019) noted opportunities in the run-up to COP 25 to raise awareness of the ocean-climate nexus and mobilize ocean-climate action, including a focus on the U.N. Secretary General's Climate Summit (SG Summit). The specific focus of the Fiji symposium was to discuss ocean issues in the context of the UNFCCC. These included raising climate ambition, increasing ocean-related mitigation, supporting ocean-related adaptation, and promoting ocean-climate science. Participants considered the symposium to be a precursor to further engagement during the June 2019 session of the UNFCCC in Bonn, Germany, where negotiators were to hone in on the most promising strategies to integrate ocean issues in the context of the UNFCCC and the leadership groups to implement them.

In the Friends of the Ocean and Climate meeting in Bonn, Chile, in its role as a host of the meeting and the president of COP25, noted that there is widespread belief that the UNFCCC should address ocean issues—a position that the forthcoming IPCC SROCC would further support—but that Parties would still need to determine the best path for integrating ocean issues into the framework of the UNFCCC.[36]

The parties then discussed initiatives that it would support the COP presidency taking in order to elevate ocean issues in the context of the UNFCCC. They considered, for example, the option of creating a new ocean-climate portal/platform, for example, that would be akin to the Non-State Actor Zone for Climate Action (NAZCA).

The meeting also focused on the possibility of the COP creating a mandate for the Subsidiary Body for Scientific and Technological Advice (SBSTA) of the UNFCCC to arrange a workshop in June 2020 on relevant cross-cutting ocean-climate issues, on the IPCC SROCC report, and on the conclusions from COP 25, which would create a bridge to COP 26. Similarly, the meeting discussed the option of SBSTA creating a work program on the ocean-climate nexus, to include tasks such as identifying key functions of the ocean that are critical for climate change, ensuring coordination of actions to develop baseline targets and deliver critical actions, and reporting to the plenary.

In its closing remarks as a host of the meeting, Fiji noted that it would be desirable for COP25, which Chile had declared would be a "Blue COP," to create a consistent and dedicated home for ocean-climate issues within the UNFCCC. A work program, for example, could ensure that there is a space that takes responsibility for the ocean-climate nexus, focuses on the status of the ocean's climate functions and benefits in the face of climate impacts, and keeps the Parties informed going forward. Parties that would like to advance the work of the Friends of the Ocean and Climate were called for a special session at the Pre-COP in Costa Rica.

At the close of the Bonn intercession, it was interesting to note an intervention from Indonesia at the plenary, who called for a special ocean work program subsequent to the outcomes of the Friends of the Ocean event. This was immediately supported by Fiji, on behalf of the Pacific Small Islands Developing States (PSIDS). An opening speech from the Alliance of Small Island States (AOSIS), a coalition of 44 states that are most vulnerable to the adverse impacts of climate change, also provided clear support to this initiative. Belize, on behalf of AOSIS, stated "COP 25 is envisioned as a "Blue COP," and due to the intrinsic link between SIDS and the ocean, AOSIS welcomes this initiative to increase dialogue on ocean issues."[37]

Building up from this session, Costa Rica together with Fiji and Indonesia, organized a special Pre-COP session in Costa Rica to discuss the initial proposal for the COP to create an ocean work program within the UNFCCC. The Pre-COP session had agreement from Parties that there are very specific reasons for the ocean-climate linkage and its central role in regulating the global

33 IPCC, 2019: Summary for Policymakers. In: IPCC Special Report on the Ocean and Cryosphere in a Changing Climate[H.-O. Pörtner, D.C.Roberts, V. Masson-Delmotte, P. Zhai, M. Tignor, E. Poloczanska, K. Mintenbeck, M. Nicolai, A. Okem, J. Petzold, B. Rama, N. Weyer (eds.)]. In press.

34 Mead, L (2019). IPCC Report Projects "Unprecedented" Changes in Ocean, Cryosphere Due to Global Warming. International Institute for Sustainable Development. Accessed on 8/10/2019 from http://sdg.iisd.org/news/ipcc-report-projects-unprecedented-changes-in-ocean-cryosphere- due-to-global-warming/

35 Because the Ocean Initiative (2019). Ocean for Climate: Ocean-Related Measures in Climate Strategies (Nationally Determined Contributions, National Adaptation Plans, Adaptation Communications, and National Policy Frameworks. Accessed on 8/10/2019 from https://www.becausetheocean.org/ocean-for-climate/

36 UNFCCC (2019). Bonn Climate Change Conference - June 2019. Accessed on 9/10/2019 from: https://unfccc.int/process-and-meetings/conferences/bonn-climate-change-conference-june-2019/bonn-climate-change-conference-june-2019

37 AOSIS (2019). Alliance of Small Island States (AOSIS) Closing Statement at the Joint Opening of the SBI50 and SBSTA 50 Sessions. World Conference Center Bonn, Germany Dated: Thursday, June 27, 2019.

climate system; however, there is an absence of institutional arrangements to properly house/manage this emphasis. Whether the Nairobi Work Programme (NWP) or existing UNFCCC agenda items on the Warsaw International Mechanism for Loss and Damage (WIM), NDCs, Adaptation communications, the Paris Committee on Capacity-building, global stock take, technology and finance facility (such as the Global Environment Facility) and so forth are best spaces to integrate this issue, still needs further deliberations. It was hence agreed, that Parties and stakeholders must solicit views on the most appropriate institutional form, which could include an ocean work programme amongst other options. Indonesia, Fiji, and Costa Rica, therefore, took the lead in creating a draft COP decision that requests the SBSTA to convene a dialogue on ocean-climate issues and on the best institutional arrangement(s) during the June 2020 intercessional meeting in Bonn, solicits views from Parties and stakeholders, and requests the SBSTA to report back to the COP for consideration at COP26. In this way, the parties would create a process at COP25 that creates a space for the ocean that the parties could adopt at COP26.

COP 25 and Beyond

It is certain that the oceans have gained momentum in the UNFCCC since the inauguration of the OPP and the Friends of the Ocean in 2017. We now have Parties that seek a formal submission to the UNFCCC secretariat as well as the COP President to formalize the ocean space in order to channel the appropriate institutional arrangements to address the ocean-climate nexus as emphasized in the various published IPCC and ocean reports, as well as the intrinsic linkages between ocean and climate change as we continue to reduce our carbon emissions and further implement the Paris Agreement. The "Blue COP" certainly has lots of hope on a political dialogue on oceans and to steer up activity in 2020 for practical and measurable ocean outcomes. This will help enhance global ocean action that will contribute to curbing GHG emissions in controlling the global temperature to well below 1.5°C in further addressing the global climate crisis.

1.6 Progress in Other UN Fora Outside of the UNFCCC

The oceans play a central role in regulating global temperature and climate. But physical and chemical changes to the oceans resulting from increasing greenhouse gas (GHG) emissions in the atmosphere are already driving significant changes to ocean systems.[38]

Climate change poses a major threat to the health and safety of humans and to an increasing number of ecosystems (Secretary-General Report on Oceans and the Law of the Sea, A/74/350, para 45 – available at https://undocs.org/en/A/74/350).

The important interlinkages between oceans and climate change are increasingly being recognized by the international community. The 2019 Climate Action Summit focused on oceans, in particular, in the context of nature-based solutions.[39] The Summit provided an opportunity for both States and private sector to make action-oriented announcements and commitments, a number of which are relevant to the ocean and climate interface (www.un.org/climatechange).

The UN General Assembly has, since 2006, encouraged States to enhance scientific activity on the impacts of climate change on oceans as well as ocean acidification, including through enhanced international cooperation and capacity-building to support research activities. Moreover, its subsidiary body, the United Nations Open-ended Informal Consultative Process on Oceans and the Law of the Sea (ICP), in 2017 discussed in depth the effects of climate change on oceans.[40] In 2019, the ICP focused its discussions on "Ocean Science and the United Nations Decade of Ocean Science for Sustainable Development" and, in that context, underlined the need to significantly enhance ocean science in the context of climate change.[41] The United Nations Decade of Ocean Science for Sustainable Development (2021-2030), proclaimed by the General Assembly and coordinated by the Intergovernmental Oceanographic Commission of UNESCO (IOC/UNESCO), will provide an important platform to increase our knowledge, inform our policy and identify effective solutions.[42]

The International Law Commission included the topic of "Sea-level rise in relation to international law" in its programme of work and established an open-ended Study Group on the topic.[43] Tuvalu proposed the development of an international legally binding instrument to create appropriate protections for persons displaced by the impacts of climate change (as discussed in the Displacement section of the Progress Report).[44] Human

38 Ove Hoegh-Guldberg and others, 2018: *Impacts of 1.5°C Global Warming on Natural and Human Systems. In: Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty.* In Press. At p. 222 available at: https://www.ipcc.ch/site/assets/uploads/sites/2/2019/06/SR15_Chapter3_Low_Res.pdf.

39 See "Information Note on the 2019 Climate Action Summit of the Secretary-General", 2019, https://www.un.org/en/climatechange/assets/pdf/Information_Note_Climate%20Summit_20Mar2019.pdf.

40 Report on the work of the United Nations Open-ended Informal Consultative Process on Oceans and the Law of the Sea at its eighteenth meeting, A/72/95, available at https://undocs.org/A/72/95.

41 Report on the work of the United Nations Open-ended Informal Consultative Process on Oceans and the Law of the Sea at its twentieth meeting, A/74/119, available at https://undocs.org/A/74/119.

42 Decade of Ocean Science for Sustainable Development (2021-2030), www.oceandecade.org

43 See seventy-first session of the International Law Commission, Sea-level rise in relation to international law," *Summaries of the Work of the International Law Commission* in 2019 available at: http://legal.un.org/ilc/summaries/8_9.shtml.

44 See draft resolution, "Providing Legal Protection for Persons Displaced

mobility in the context of climate change and natural disasters was discussed during the Caribbean migration consultations.[45] (A/74/350, para 46)

Air pollution from ships will be reduced as a result of the entry into force on 1 January 2020 of the global limit of 0.50 per cent on sulphur in fuel oil under Annex VI to the International Convention for the Prevention of Pollution from Ships (MARPOL), as discussed in more detail in the Progress Report section on Mitigation). For ships operating in designated emission control areas the limit continues to be 0.10 per cent.[46] IMO approved a programme up to 2023 of follow-up actions to its initial strategy on reduction of GHG emissions from ships. Work also began on the fourth IMO GHG study that will update emissions estimates from international shipping from 2012 to 2018. With respect to energy efficiency, new guidelines were adopted on the method of calculation of the attained energy efficiency design index for new ships and measures were approved to strengthen mandatory requirements for new ships and to encourage their cooperation with ports. A voluntary multi-donor trust fund was also established to support technical cooperation and capacity-building activities on reduction of GHG emissions from ships. Furthermore, an IMO-Norway project, GreenVoyage-2050, was launched to demonstrate and test technical solutions for reducing GHG emissions in shipping and to build capacity in developing countries, including SIDS and least developed countries (LDCs)[47] (A/74/350, para 49).

In the context of fisheries, FAO published a technical paper on deep-ocean climate change impacts on habitat, fish and fisheries[48] (A/74/350, para 51).

Efforts are also being made to integrate climate vulnerability considerations in planning and zoning processes.[49] UNEP's project on coral reef resilience and vulnerability to climate change in Malaysia concluded in 2019 and demonstrated an approach and model to improve marine spatial planning for a more climate resilient network of marine protected areas by integrating climate vulnerability considerations in planning and zoning processes (A/74/350, para 86).

The World Meteorological Organization, in its *Statement on the State of the Global Climate in 2018*, highlighted that the world continued to see increasing ocean heat content, rising sea levels, with some acceleration, and increasing concentrations of greenhouse gases, while the cryosphere continued its contraction, with global sea ice shrinking.

The World Meteorological Organization and IOC/UNESCO, with the advice of the Joint WMO-IOC Collaborative Board,[50] is providing assistance to States in improving forecasting, including impact-based forecasting, of extreme weather events and its application in multi-hazard early warning systems and risk management under a more integrated approach to addressing the impacts of flooding types from multiple sources (including marine-, river- and geophysical-related) and severe weather.[51]

1.7 Developments at G20 and at G7

In addition to advances on the oceans and climate issues within the UNFCCC and in other UN fora, there was progress on this topic in the context of multilateral summits led by the G20 and the G7 countries in 2019.

The G20 Summit

The G20 Summit on Financial Markets and the World Economy is held every year to discuss the critical issues affecting the global economy, and the members are composed of the G7 (France, the United States, the United Kingdom, Germany, Japan, Italy, Canada and the European Union), as well as Argentina, Australia, Brazil, China, India, Indonesia, Mexico, the Republic of Korea, Russia, Saudi Arabia, South Africa, and Turkey. All of the countries are in fact coastal states.

On the 28th and 29th of June 2019, world leaders from the G20 countries gathered for the G20 Summit in Osaka, Japan. A series of Ministerial Meetings were also held at eight different locations within the country during 2019, starting from the Agriculture Ministers' Meeting in Niigata in May, followed by the Finance Ministers and Central Bank Governors Meeting in Fukuoka city, the Ministerial Meeting on Trade and Digital Economy in Tsukuba city, and the Ministerial Meeting on Energy Transitions and Global Environment for Sustainable Growth in Karuizawa town held in June.

Among G20 engagement groups, representing the voices of business, civil society, labor union, science, think tanks, women and youth, the science community, in particular, has been focusing its attention on the vital role of oceans and the need for conservation. In 2019, representatives from the national academies of sciences of G20 nations developed a joint statement titled "Threats to Coastal and Marine Ecosystems, and Conservation of the Ocean Environment ~~-~~with Special Attention

by the Impacts of Climate Change", A/73/L.105, paras. 10 and 11.

45 UNHCR contribution.

46 IMO contribution.

47 Ibid.

48 FAO contribution; FAO, 2019. *Deep-ocean climate change impacts on habitat, fish and fisheries,* by Lisa Levin, Maria Baker, and Anthony Thompson (eds). FAO Fisheries and Aquaculture Technical Paper No. 638. Rome, FAO. 186 pp.

49 UNEP contribution. UNEP's project on coral reef resilience and vulnerability to climate change in Malaysia concluded in 2019 and demonstrated an approach and model to improve marine spatial planning for a more climate resilient network of marine protected areas by integrating climate vulnerability considerations in planning and zoning processes.

50 Established through WMO Resolution 9 (Cg-18) and IOC Resolution XXX-2, which also disbanded the Joint WMO-IOC Technical Commission for Oceanography and Marine Meteorology (JCOMM).

51 WMO Resolution 15 (Cg-18).

to Climate Change and Marine Plastic Waste,"[52] which was handed over to Prime Minister Shinzo Abe on March 6, 2019, in order to inform and urge the world leaders to take more decisive policy actions towards sustainable ocean management. The document included six major recommendations, such as to apply evidence-based assessment in ecosystem approaches for further development of marine resources, to redouble actions aiming to address climate change, overfishing and pollution, to establish more recycling and energy efficient practices, to build capacities for research infrastructure and human capital, to improve data storage and management system for open access, and to share research information to expedite the understanding of the global ocean and its dynamics.

As an outcome of the G20 Summit, "G20 Osaka leaders' declaration" was adopted,[53] which emphasized the leaders' commitment to use all policy tools to achieve strong, sustainable, balanced and inclusive growth, to put in place and respect legal frameworks for data free flow with trust to harness the opportunities of the digital economy, and to pursue the "Osaka Blue Ocean Vision" which aims to reduce additional pollution by marine plastic litter to zero by 2050, among other pressing global issues. Prime Minister Abe announced that Japan would support developing countries' efforts including their capacity building and infrastructure development in the area of waste. To this end, the Government of Japan has launched the "MARINE Initiative" to advance effective actions to combat marine plastic litter at a global scale focusing on: (1) Management of wastes, (2) Recovery of marine litter, (3) Innovation, and (4) Empowerment. In the declaration, the signatories to the Paris Agreement reaffirmed their commitment to its full implementation, while the United States also reiterated its decision to withdraw from the Paris Agreement. As part of the G20 Osaka Summit Partners' Program, a symposium on "The Sea: Sparkling Source of Life" was held in Osaka, which was hosted by Mrs. Akie Abe, spouse of the Prime Minister of Japan. The next G20 summit will take place in Saudi Arabia in 2020, in Italy in 2021, and in India in 2022.

The G7 Summit

France, under its 2019 G7 Presidency, took a step forward to put the ocean on the negotiation table.

For its 2019 edition, the G7 Summit centered around the fight against inequalities. Throughout the year, G7 Ministerial meetings were held to answer this priority, including a meeting of the Environment Ministers (Metz, 5-6 May 2019) focused on "Fighting inequality by protecting biodiversity and climate." The Presidential Summit (24-26 August) was held on the Atlantic coast, in Biarritz, and offered an opportunity to draw the attention of the international community to the need for better protection of the marine environment.

G7 Environment Ministers meeting (5-6 May, Metz)

The link between climate change and inequality is undeniable, given its impacts--such as through coastal erosion, cyclones, floods and health issues--on human societies and especially vulnerable communities.

As a major outcome of their meeting, G7 Ministers adopted the Metz Charter on Biodiversity[54] which made specific references to ocean life and resources, in particular to freshwater and marine ecosystems, and recognized the UN Decade of Ocean Science for Sustainable Development (2021-2030). Based on the alarming observation made by the IPBES in its *Global Assessment Report on Biodiversity and Ecosystem Services*,[55] this Charter seeks to accelerate and intensify signatories' efforts to halt the loss of biodiversity, to value, conserve, restore and wisely use biodiversity. This document was later endorsed by the G7 Heads of State and Government in Biarritz.

Civil society was also convened to exchange with the G7 delegations regarding pressing environmental issues. In that regard, the Ocean & Climate Platform[56] organized a conference on the Ocean, climate and biodiversity nexus. Key experts and scientists discussed the impacts of climate change on ocean health and the urgent action world leaders need to undertake to safeguard people and planet, including on regulating international shipping, industrial fishing, and the protection of marine ecosystems.

In their final communiqué[57], Ministers recognized *"that the ocean warrants special attention in the discussions related to climate change, including the impacts of ocean warming, acidification and deoxygenation on marine ecosystems, and on coastal communities and infrastructures."*

52 http://www.s20japan2019.org/s20/pdf/revised_S20Japan2019Statement.pdf

53 https://www.consilium.europa.eu/media/40124/final_g20_osaka_leaders_declaration.pdf

54 Metz Charter on Biodiversity, May 2019: https://www.elysee.fr/admin/upload/default/0001/04/e69a15d02877b265898bd98391adf06fa0bff386.pdf

55 IPBES (2019): Summary for policymakers of the global assessment report on biodiversity and ecosystem services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. S. Díaz, J. Settele, E. S. Brondízio E.S., H. T. Ngo, M. Guèze, J. Agard, A. Arneth, P. Balvanera, K. A. Brauman, S. H. M. Butchart, K. M. A. Chan, L. A. Garibaldi, K. Ichii, J. Liu, S. M. Subramanian, G. F. Midgley, P. Miloslavich, Z. Molnár, D. Obura, A. Pfaff, S. Polasky, A. Purvis, J. Razzaque, B. Reyers, R. Roy Chowdhury, Y. J. Shin, I. J. Visseren-Hamakers, K. J. Willis, and C. N. Zayas (eds.). IPBES secretariat, Bonn, Germany. 56 pages. https://doi.org/10.5281/zenodo.3553579

56 Ocean & Climate Platform – website: https://ocean-climate.org/?lang=en

57 Communiqué - G7 Environment Ministers meeting, May 2019: https://www.elysee.fr/admin/upload/default/0001/04/7d84becef82b656c-246fa1b26519567ce3755600.pdf

Ocean Pavilion, pre-G7 Summit and Ocean Call (20-24 August, Biarritz)

By organizing an "Ocean Pavilion" in the lead up to the G7 Summit, Surfrider Foundation Europe[58] wanted to promote the importance of the ocean to the heads of state who met in Biarritz. This pre-summit consisted of four days of conferences and workshops leading to the development of a formal written declaration to highlight and call G7 leaders to act for the ocean.

This forum welcomed experts and key stakeholders, including the French Minister for Ecological and Solidary Transition, Ms. Elisabeth Borne, and highlighted the strong commitment of local, private and civil society to the preservation of the ocean.[59] It further drew the attention of the international community to the need for better protection of the marine environment, on the eve of the release of the IPCC Special Report on the ocean and the cryosphere.

On 24 August, opening day of the G7 Summit, the French President Emmanuel Macron received and acknowledged the Ocean Call,[60] co-signed by over 50 actors from civil society committed to ocean protection, including the Global Ocean Forum, the Ocean and Climate Platform and the Global Ocean Trust.

Despite the effort being successful with the delivery of an engaging collective declaration to the Group of 7, the following political declarations showed to be not yet up to the challenges.

G7 Summit (Biarritz, August 24th, 25th and 26th)

A dedicated session of the G7 was organized under the theme of "Climate, Biodiversity and Oceans."[61] to which several outreach countries were invited, including India, Chile and Australia, as well as representatives of civil society.

The Presidency recalled that climate change, biodiversity loss, and ocean and land degradation were three interconnected key global challenges that threaten peace, security, development, health and economic stability, especially in the most vulnerable countries. The Leaders discussed the importance of ensuring more equal access to low-emission, efficient, affordable, and reliable energy in line with individual nations' climate goals and low-emission strategies and the protection of the environment and the ocean.

Several countries expressed their willingness to increase the collective ambition of their nationally determined contributions (NDC) under the Paris Agreement by 2020, building on the momentum of COP25 under the Chilean Presidency and taking into account that further global efforts are needed. Leaders were informed that this COP will give a prominent role to the protection of the ocean, stress the key role of science and underscore the need for a multi-stakeholder approach, with a strong focus on adaptation measures, including by the private sector and civil society. The role of the NDC Partnership in supporting developing and emerging market economies in implementing their NDCs and raising ambition was highlighted. Several G7 countries announced ambitious contributions to help replenish the Green Climate Fund, reaching an overall amount of USD 5.5 billion.

In his opening speech, the President of the French Republic, Emmanuel Macron, spoke of "the call of the ocean and the forest." The consultations that followed were marked by three notable environmental announcements, all three related to the ocean:

- The *Maritime Coalition for Climate and Environment*, which aims at limiting the international maritime sector's impact on climate change. This coalition, which mainly includes carriers and shipowners, commits to reducing the greenhouse gases produced by ships by 40% by 2030. Moreover, CMA-CGM, the world leader in container shipping, pledged not to use the North Route that has opened as a consequence of the melting ice.
- The adoption of a *Charter for Biodiversity*. Signed by all G7 countries, it is a first step towards the COP 15 on biodiversity in China next year.
- The *Sustainable Fashion Coalition*, which involves 32 companies representing nearly 30% of the world's fashion industry and aims at reducing the environmental footprint of textiles which is notably responsible for up to 35% of primary microplastic pollution in the ocean.

These measures are considered positive but must now receive the support of other states since no agreement was reached in Biarritz, and no supervisory body has been established to verify that these commitments actually lead to concrete results.

Moreover, following the G7 Parliament meeting (5-7 September, Brest), the Parliaments reaffirmed their commitment to the Ocean in a Speaker's Declaration[62] emphasising the importance of a general commitment to the ocean as a common good: the protection of the ocean and its resources is a major world issue which must bring together all public and private actors.

58 Surfrider Foundation Europe – website: https://surfrider.eu/en/

59 Surfrider Foundation Europe, Press release, 2019: https://surfrider.eu/en/learn/news/g7-summit-mixed-outcomes-for-the-ocean-surfriders-advocacy-continues-121910197615.html

60 Ocean Call, released on August 23rd, 2019: https://surfrider.eu/wp-content/uploads/2019/08/oceancall_long_EN.pdf

61 Biarritz Chair's Summary on Climate, Biodiversity and Oceans, August 2019: https://www.consilium.europa.eu/media/40537/biarritz-chair-s-summary-on-climate-biodiversity-and-oceans.pdf

62 G7 Speakers' Declaration, September 2019: https://www.speaker.gov/sites/speaker.house.gov/files/G7%20Brest%202019%20-%20Final%20Joint%20Declaration.pdf

Conclusions

Through the visibility that its annual meeting provides and the variety of the actors that the French Presidency succeeded in bringing together, the 2019 G7 has made it possible to launch a real international dynamic in favor of a global awareness of the urgent need to act for the ocean. Based on the recommendations of scientists and taking advantage of their media impact, the French Presidency enabled the launch of symbolically strong initiatives for the protection of the ocean and its marine biodiversity.

Nevertheless "it is only the beginning, we are very far from having won [the battle for the ocean]," President Emmanuel Macron recalled at the United Nations General Assembly on 24 September. Thus, on the eve of a busy and crucial international agenda for the future of climate, biodiversity and the ocean, the G7 Presidency has breathed new life into the process, but the hardest part remains to be done in the coming months, when strong commitments from governments, businesses and civil society are expected.

1.8 Developments at Regional Levels: Examples from the Pacific

Pacific Island Countries and Territories

The Pacific saw important developments on the climate-ocean nexus since UNFCCC COP24.

At the regional level, the 50th Pacific Islands Forum held in Tuvalu in August 2019 was the opportunity for Leaders to endorse "the development of a 2050 Strategy for the Blue Pacific Continent, while acknowledging the need for urgent, immediate actions on the threats and challenges of climate change facing the Blue Pacific.". They also "reaffirmed the importance of preserving Members' existing rights stemming from maritime zones, in the face of sea level rise. Leaders committed to a collective effort, including to develop international law, with the aim of ensuring that once a Forum Member's maritime zones are delineated in accordance with the 1982 UN Convention on the Law of the Sea, that the Members maritime zones could not be challenged or reduced as a result of sea-level rise and climate change." The Kainaki II Declaration for Urgent Climate Change Action Now states that "as Leaders of the Pacific Islands Forum, custodians of the world's largest ocean and carbon sink, and representatives of our Pacific peoples, we call for immediate action and not just discussion of ambition." Leaders also invited "all parties attending COP25 to welcome the focus on oceans, and consider developing a work programme on oceans within the United Nations Framework Convention on Climate Change process and convene a workshop on the climate-ocean nexus in 2020."

On that topic, it should be noted that the Government of Fiji played an active role in co-convening the pre-COP climate and ocean negotiators' symposium on 7 October 2019 in San Jose (Costa Rica). As a result, Indonesia, Fiji, and Costa Rica proposed a draft COP decision on better integration of ocean issues and opportunities in the UNFCCC and on active engagement of SBSTA to convene a dialogue on the issue.

Other significant developments at the regional level include the June 2019 Pacific Community's 49th meeting of the Committee of Representatives of Governments and Administrations (CRGA) and 11th Conference, where SPC members agreed to expand the Pacific Community Centre for Ocean Science (PCCOS) and called for donors and partners to make a greater investment in scientific research into the impacts of changing climate on our oceans. Then in July 2019 the Pacific Community Workshop on the UN Decade of Ocean Science for Sustainable Development 2021-2030, co-hosted by SPC and IOC-UNESCO, dedicated significant attention to new science needed to strengthen ocean resilience facing climate change.

At the national level, about two thirds of Pacific Island Countries now have NDC implementation strategies in place.[63] Several are starting reviewing their NDCs to increase their level of ambition, in line with the Paris Agreement. The Republic of the Marshall Islands was the first UNFCCC Party worldwide to issue a new NDC in November 2018.

Pacific Island Countries and Territories are also increasingly developing comprehensive ocean policies and associated governance mechanisms, which make strong connections with climate change. Illustrative examples are the Cook Islands' Marae Moana Policy 2016-2020, the rationale of which includes that "healthy ecosystems are more resilient against the adverse impacts of climate change." The policy also, for example, provides that "any marine or oceanic development shall have a low ecological footprint, positive social impact and be resilient to impacts of climate change." Vanuatu's 2016 National Ocean Policy dedicates an entire Action Area to Climate change and disaster risk reduction, and officially "contributes to Vanuatu's efforts to implement Sustainable Development Goal 14 on Oceans, to build marine ecosystem resilience to climate change." Among the most recently adopted, Solomon Islands' 2018 National Ocean Policy "aims to define and strengthen integrated ocean governance at various levels, and across sectors, to achieve national, regional and global ocean related sustainable development goals on socio-economic development, food security, climate change resilience and adaptation."

63 Doyle A. 2019. The Heat Is On. Taking Stock of Global Climate Ambition. UNDP, New York, USA.

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

2.1 The Report on the Ocean and Cryosphere in a Changing Climate (SROCC)

Here we summarise the ocean aspects of the SROCC assessment, approved and released in September 2019, while recognizing how the ocean and cryosphere (frozen regions of the planet) are inevitably interlinked especially with regard to sea level rise.

SROCC assesses new knowledge since the 2013-14 IPCC fifth assessment report (AR5) and its 2018 1.5oC report. It covers how the ocean and cryosphere have and are expected to change (mainly under low (RCP2.5) and high (RCP8.5) greenhouse gas emissions scenarios) with continued global warming, the risks and opportunities these changes bring to ocean physics, ecosystems and society, and mitigation, adaptation and governance options for reducing future risks.

We draw heavily on the Summary for Policy Makers (SPM) available here: https://report.ipcc.ch/srocc/pdf/SROCC_SPM_Approved.pdf while greater details of this unprecedented assessment can be found in the 6 chapters and the Integrative Cross-Chapter Box comprising the SROCC (downloadable here: https://www.ipcc.ch/srocc/download-report/). Of particular interest to the ocean community are Chapter 1: Framing and Context of the Report, Chapter 3: Polar Regions, Chapter 4: Sea Level Rise and Implications for Low Lying Islands, Coasts and Communities, Chapter 5: Changing Ocean, Marine Ecosystems, and Dependent Communities, Chapter 6: Extremes, Abrupt Changes and Managing Risks and the Integrative Cross-Chapter Box: Low Lying Islands and Coasts.

The SROCC assessment highlights the urgency of prioritizing timely, ambitious and coordinated action to address unprecedented and enduring changes in the ocean and cryosphere. SROCC brings together in one place, for the first time, a view of profound and multiple changes taking place and their potential consequences. Unless rapid action is taken to reduce greenhouse gas emissions, it paints a bleak picture and the dire consequences of not meeting the Paris Agreement. It shows that the world's ocean and cryosphere have been 'taking the heat' for climate change for decades. Up until now, the ocean has taken up more than 90 percent of the excess heat in the climate system. By 2100, the ocean will take up 2 to 4 times more heat than between 1970 and the present if global warming is limited to 2°C, and up to 5 to 7 times more at higher emissions. Ocean warming reduces mixing between water layers and, as consequently, reduced supply of oxygen and nutrients for marine life.[64] The consequences for nature and humanity are sweeping and severe. The report highlights the urgency of timely, ambitious, coordinated, and enduring action at all levels. What's at stake is the health of ocean biodiversity and ecosystems, their ecosystem services, the well-being and health of millions of low-lying and coastal communities, and, importantly, the world we leave our children. It provides the best available scientific knowledge to empower people, communities and governments to tackle the unprecedented transitions in all aspects of society, including governance, energy, land and ecosystems, urban and infrastructures as well as industry that would be needed to deliver on the Paris Agreement. The report gives evidence of the benefits of combining scientific with local and indigenous knowledge to develop suitable options to manage climate change risks and enhance resilience. The more decisively and earlier we act, the more able we will be to address unavoidable changes, manage risks, improve our lives and achieve sustainability for ecosystems and people around the world – today and in the future.

"All people on Earth depend directly or indirectly on the ocean and cryosphere…. The ocean and cryosphere support unique habitats, and are interconnected with other components of the climate system through global exchange of water, energy and carbon. The projected responses of the ocean and cryosphere to past and current human-induced greenhouse gas emissions and ongoing global warming include climate feedbacks, changes over decades to millennia that cannot be avoided, thresholds of abrupt change, and irreversibility."

It assesses that the ocean has been impacted by climate change over many decades resulting in sea level rise, warming, acidification and oxygen loss, which will intensify over this century to unprecedented levels. The report showed that while sea level has risen globally by around 15 cm during the 20th century, it is currently rising more than twice as fast–3.6 mm per year–and accelerating (A3.1). Sea level will continue to rise for centuries. Under RCP2.6, the rate is projected to reach 4 mm a yr-1 (2-6 mm yr-1, likely range) in 2100.[65] It could reach around 30-60 cm by 2100 even if greenhouse gas emissions are sharply reduced and global warming is limited to well below 2°C, but around 60-110 cm if greenhouse gas emissions continue to increase strongly.

64 IPCC, 2019: Choices made now are critical for the future of our ocean and cryosphere. IPCC PRESS RELEASE 25 September 2019. 2019/31/PR

65 IPCC, 2019: Summary for Policymakers. In: IPCC Special Report on the Ocean and Cryosphere in a Changing Climate [H.- O. Pörtner, D.C. Roberts, V. Masson-Delmotte, P. Zhai, M. Tignor, E. Poloczanska, K. Mintenbeck, M. Nicolai, A. Okem, J. Petzold, B. Rama, N. Weyer (eds.)]. In press.

Marine heatwaves have doubled in frequency since 1982 and are projected to further increase in frequency, duration, extent and intensity. Their frequency will be 20 times higher at 2°C warming, compared to pre-industrial levels. They would occur 50 times more often if emissions continue to increase strongly.[66] Extreme El Niño and La Niña events will be more frequent, there will be increases in intensity of tropical cyclone winds and rainfall, and increases in extreme waves, extreme sea level events and coastal hazards.

"Over the 21st century, the ocean is projected to transition to unprecedented conditions with increased temperatures (virtually certain), greater upper ocean stratification (very likely), further acidification (virtually certain), oxygen decline (medium confidence), and altered net primary production (low confidence). Marine heatwaves (very high confidence) and extreme El Niño and La Niña events (medium confidence) are projected to become more frequent. The Atlantic Meridional Overturning Circulation (AMOC) is projected to weaken (very likely). The rates and magnitudes of these changes will be smaller under scenarios with low greenhouse gas emissions (very likely)."

66 IPCC, 2019: Choices made now are critical for the future of our ocean and cryosphere. IPCC PRESS RELEASE 25 September 2019. 2019/31/PR

The ocean has taken up between 20 to 30 percent of human-induced carbon dioxide emissions since the 1980s, causing ocean acidification. Continued carbon uptake by the ocean by 2100 will exacerbate ocean acidification.[67]

These changes are already impacting biodiversity and ecosystem functioning and services but as their frequency or intensity increase over the 21st century there will be further losses of species habitat and diversity, reduction in ocean productivity and degradation or even loss of ecosystem function.

"A decrease in global biomass of marine animal communities, their production, and fisheries catch potential, and a shift in species composition are projected over the 21st century in ocean ecosystems from the surface to the deep seafloor under all emission scenarios (medium confidence). The rate and magnitude of decline are projected to be highest in the tropics (high confidence), whereas impacts remain diverse in polar regions (medium confidence) and increase for high emission scenarios. Ocean acidification (medium confidence), oxygen loss (medium confidence) and reduced sea ice extent (medium confidence) as well as non-climatic human activities (medium

67 Ibid

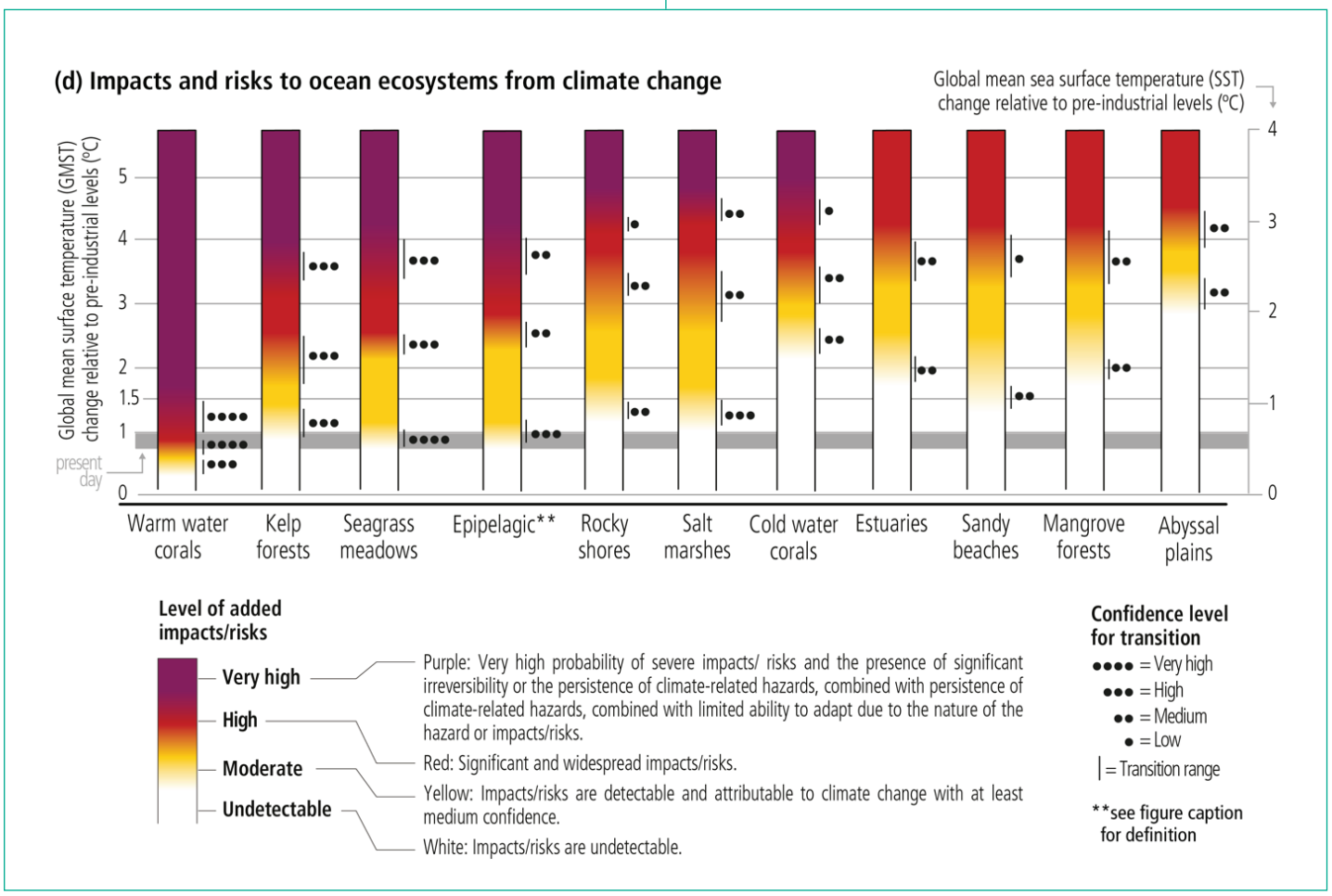

Figure 1. IPCC SROCC Figure 3d: Assessment of risks for coastal and open ocean ecosystems based on observed and projected climate impacts on ecosystem structure, functioning and biodiversity (see https://report.ipcc.ch/srocc/pdf/SROCC_SPM_Approved.pdf for details).

confidence) have the potential to exacerbate these warming-induced ecosystem impacts."

"The capacity of organisms and ecosystems to adjust and adapt is higher at lower emissions scenarios (high confidence). For sensitive ecosystems such as seagrass meadows and kelp forests, high risks are projected if global warming exceeds 2°C above pre-industrial temperature, combined with other climate-related hazards (high confidence). Warm water corals are at high risk already and are projected to transition to very high risk even if global warming is limited to 1.5°C (very high confidence)."

The impacts on ecosystem services will have negative consequences for health, well-being and livelihoods for dependent Indigenous peoples and local communities.

"Future shifts in fish distribution and decreases in their abundance and fisheries catch potential due to climate change are projected to affect income, livelihoods, and food security of marine resource-dependent communities (medium confidence). Long-term loss and degradation of marine ecosystems compromises the ocean's role in cultural, recreational, and intrinsic values important for human identity and well-being (medium confidence)."

The report highlights actions that can be taken to protect ocean ecosystems and the services and values they provide.

".....options provided by ocean ecosystems can be supported by protection, restoration, precautionary ecosystem-based management of renewable resource use, and the reduction of pollution and other stressors (high confidence)."

Sea level continues to rise but at an accelerated rate and under the high emissions scenario there is high to very high risk for vulnerable communities in coral reef environments, urban atoll islands and low-lying Arctic locations this century due to adaptation limits being reached. Areas at this level of risk are projected to expand beyond 2100, due to the long-term commitment of sea level rise with some island nations likely to become uninhabitable. Delta regions and coastal cities are projected to experience moderate to high risk levels after 2050 under current adaptation under the high emissions scenario.

"Extreme sea level events that are historically rare (once per century in the recent past) are projected to occur frequently (at least once per year) at many locations by 2050 in all RCP scenarios, especially in tropical regions (high confidence). The increasing frequency of high water levels can have severe impacts in many locations depending on exposure (high confidence). Sea level rise is projected to continue beyond 2100 in all RCP scenarios. For a high emissions scenario (RCP8.5), projections of global sea level rise by 2100 are greater than in AR5 due to a larger contribution from the Antarctic Ice Sheet (medium confidence). In coming centuries under RCP8.5, sea level rise is projected to exceed rates of several centimetres per year resulting in multi-metre rise (medium confidence), while for RCP2.6 sea level rise is projected to be limited to around 1m in 2300 (low confidence). Extreme sea levels and coastal hazards will be exacerbated by projected increases

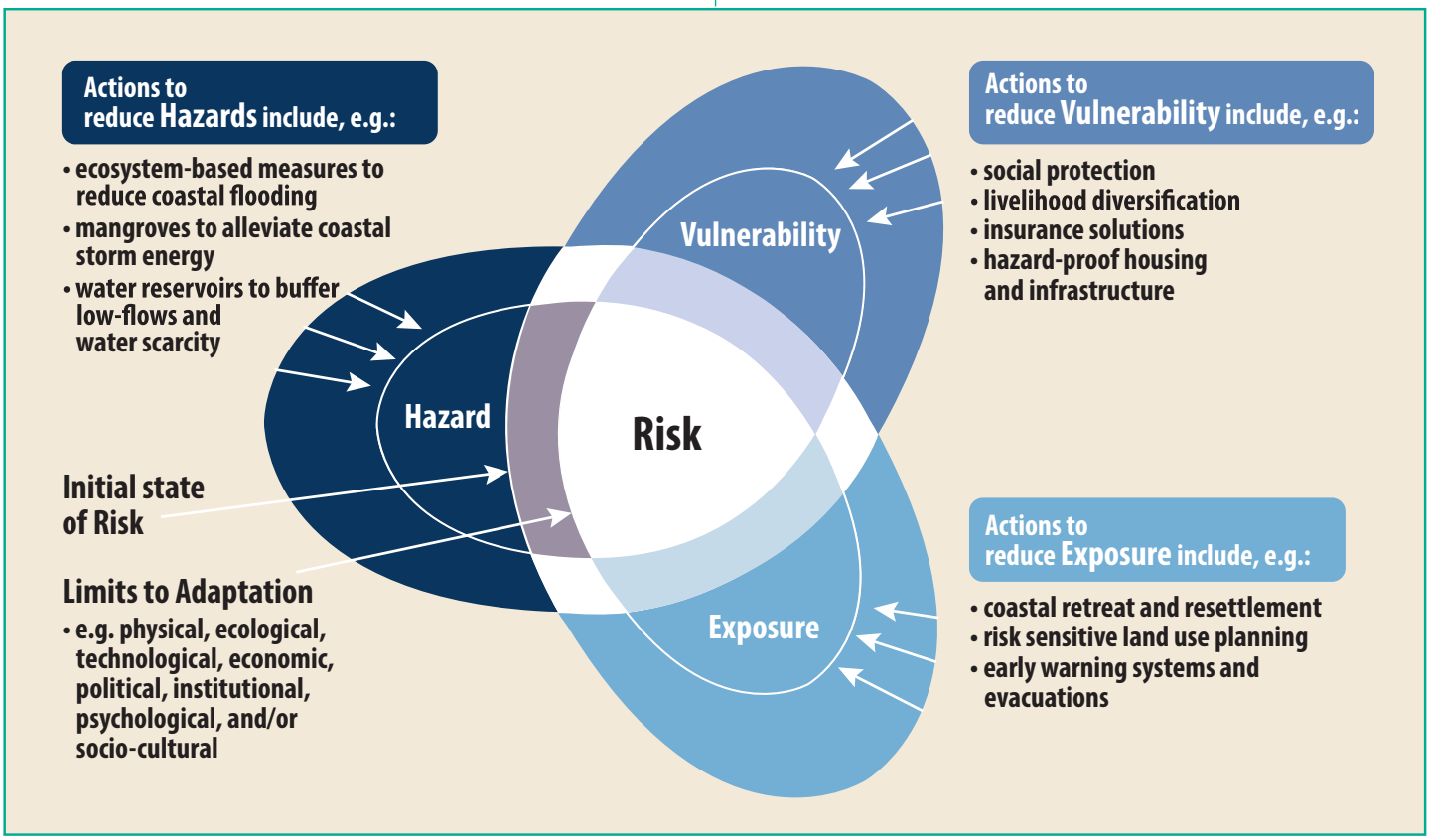

Figure 2. IPCC SROCC Risk Reduction Through Adaptation

in tropical cyclone intensity and precipitation (high confidence). Projected changes in waves and tides vary locally in whether they amplify or ameliorate these hazards (medium confidence)."

Figure to show there are options for risk reduction through adaptation. Adaptation can reduce risk by addressing one or more of the three risk factors: vulnerability, exposure, and/or hazard. The reduction of vulnerability, exposure, and/or hazard potential can be achieved through different policy and action choices over time until limits to adaptation might be reached (IPCC SROCC Chapter 1, Chapter Box CB2.1).

Many hundreds of millions of people in low-lying coastal and Small Island Developing State (SIDS) communities are also exposed to multiple hazards, including tropical cyclones, extreme sea levels and flooding, marine heatwaves, sea ice loss, and permafrost thaw and as these intensify or become more frequent risks to these human communities will exacerbate. Permafrost ground that has been frozen for many years is warming and thawing and widespread permafrost thaw is projected to occur in the 21st century. Even if global warming is limited to well below 2°C, around 25 percent of the near-surface (3-4 meter depth) permafrost will thaw by 2100. If greenhouse gas emissions continue to increase strongly, there is a potential that around 70 percent near-surface permafrost could be lost.[68]

"The low-lying coastal zone is currently home to around 680 million people (nearly 10 percent of the 2010 global population), projected to reach more than one billion by 2050. SIDS are home to 65 million people."

Low-lying islands and coasts are already experiencing the impacts of climate-related changes to the ocean and cryosphere, from both extreme events and slow onset changes whether they are urban or rural, continental or island, at any latitude and regardless of level of development.

"Over the course of the 21st century, they are expected to experience both increasing risks and limits to ecological and societal adaptation due to their low elevation, narrow ecological zonation, climate sensitive ecosystems and natural resources, as well as increasing anthropogenic pressures."

The magnitude of projected impacts depends on future greenhouse gas emissions and the associated climate changes, as well as on other drivers such as population movement into or out of risk-prone areas and societal efforts to adapt. Adaptation will be a challenge and will likely require a number of different options depending on finance and the specific needs and constraints of the communities.

"Coastal communities face challenging choices in crafting context-specific and integrated responses to sea level rise that balance costs, benefits and trade-offs of available options and that can be adjusted over time (high confidence). All types of options, including protection, accommodation, ecosystem-based adaptation, coastal advance and retreat, wherever possible, can play important roles in such integrated responses (high confidence)."

"Ambitious adaptation including transformative governance could reduce risk. However, ecological, financial, institutional and governance constraints for such actions exist (high confidence), and in many contexts ecosystem-based adaptation will only be effective under the lowest levels of warming (high confidence)."

The report concludes by highlighting the critical need for *both* urgent, ambitious and coordinated implementation of low-emission pathways *and* adaptation actions to reduce the impact on the ocean and cryosphere.

"Enabling climate resilience and sustainable development depends critically on urgent and ambitious emissions reductions coupled with coordinated sustained and increasingly ambitious adaptation actions (very high confidence)."

The assessment mentions the escalating costs and risks of delayed action and the benefits of limiting impact through the implementation of the Paris Agreement. It acknowledges the challenge and need for:

"... intensifying cooperation and coordination among governing authorities across spatial scales and planning horizons will be essential. Education and climate literacy, monitoring and forecasting, use of all available knowledge sources, sharing of data, information and knowledge, finance, addressing social vulnerability and equity, and institutional support are also essential. Such investments enable capacity building, social learning, and participation in context-specific adaptation, as well as the negotiation of trade-offs and realisation of co-benefits in reducing short-term risks and building long-term resilience and sustainability."

The evidence is in; this unprecedented report packs a punch, showing clearly that the consequences for nature and humanity of not meeting the Paris Agreement are sweeping and severe. Meeting the Paris Agreement will greatly reduce the risk to nature and humanity but this will be a challenge requiring all society, all nations and all actors to work together at levels not seen before. The time for action is now, not tomorrow.

2.2 Other Scientific and Policy Developments: Ocean Deoxygenation, Ocean Acidification, Multiple Stressors

Ocean Deoxygenation Update

The literature on ocean deoxygenation continues to grow, revealing key insights about regional and verti-

68 IPCC, 2019: Choices made now are critical for the future of our ocean and cryosphere. IPCC PRESS RELEASE 25 September 2019. 2019/31/PR

cal patterns of oxygen loss and the potential drivers.[69] Key factors influencing oxygen loss in coastal waters include changes in circulation and oxygen declines in source waters (up to 40% loss off Monterey Bay[70]), strengthened inputs from poorly oxygenated water masses[71] and reduced inputs of oxygenated water masses in fjords.[72] In many regions natural variability masks long term, climate-driven trends. For example, in the Pacific Ocean oxygen decreases in the positive Pacific Decadal Oscillation (PDO) phase and increases in the 50 to 300 m layer during the negative PDO.[73] El Niño and La Niña years, which also influence oxygenation are superimposed on these. Spatial variation in natural variability create regional differences in when the climate-signal in oxygen change will emerge with a range of 0-80 years.[74,75] New models suggest that current trends of oxygen decline may reverse around 2150 as export of primary production declines.[76]

However, mechanistic understanding of oxygen controls remain insufficient; there are large discrepancies between observed and modeled oxygen content of the ocean, particularly in the tropics.[77,78] Similarly little is known about how oxygen loss affects ecosystem services regionally, or modeling of the economic and social consequences of ocean deoxygenation.[79]

Oxygen loss is understood to cause loss of habitat and biodiversity.[80] However recent studies of deoxygenation reveal new modes of oxygen influence, for example via impairment of larval vision in cephalopods and crustaceans,[81] altered growth and reproductive rates in sea urchins,[82] via transgenerational effects on fish reproduction,[83] through alteration of nutrient fluxes,[84] reduced efficiency of food webs,[85] and strong small-scale spatial variability affecting zooplankton.[86] Deoxygenation re-shapes the diversity, composition, abundance, and distribution of marine microbes and animals and thus there is concern over the projected expansion of the preindustrial area of oxygen minima (< 80 µmol kg^{-1}) by 7% through 2100.[87]

Understanding of deoxygenation impacts on fisheries have been advanced by linking physiology with earth system model projections to assess vulnerability in tuna[88] and changes in fish distributions, biomass and production.[89,90,91] New proxies for assessing fish exposure to hypoxia and implications for growth and metabolism are being developed based on elemental composition of otoliths (fish ear bones).[92] Variability of the oxycline and its impact on the ecosystem (VOICE) is a new program exploring the relationship between the upper oxycline and fisheries in upwelling ecosystems.[93] Several

69 Levin LA. (2018). Manifestation, Drivers, and Emergence of Open Ocean Deoxygenation. Annual Review of Marine Science, 10, 229-260.

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studies have also revealed some non-commercial fish species that are remarkably tolerant to exceptionally low oxygen conditions.[94,95]

Recognition of ocean deoxygenation as a major consequence of climate change has grown substantially within the scientific and policy communities over the past year through the efforts of the IOC-UNESCO Global Ocean Oxygen Network[96,97] and the Kiel Declaration on Ocean Deoxygenation[98] released in conjunction with a major deoxygenation symposium and signed by over 500 scientists. A global Conservation Horizon Scan indicates awareness of the subject rose from 50 percent in 2010 to 82 percent of respondents in 2018, with a change from 8 to 25 percent actually engaged in the issue.[99] The recent IPCC Special Report on Ocean and Cryosphere in a Changing Climate has identified deoxygenation alongside ocean warming and ocean acidification as a major threat to ocean ecosystems and human well-being,[100] and Chapter 5 of the report on oceans discusses in detail the mechanisms and system-level consequences of ocean deoxygenation. Even coral reefs are now recognized as vulnerable to major oxygen loss.[101] The failure to mention ocean deoxygenation in the first draft of a new treaty on the conservation and sustainable use of marine biological diversity of areas beyond national jurisdiction led to the generation of a policy brief on deoxygenation.[102] This awareness is likely to grow even more with the December release of an IUCN report *Ocean deoxygenation: Everyone's problem. Causes, impacts, consequences and solutions*. This report, involving 67 scientific experts from 42 institutes in 17 countries, is the largest peer-reviewed study conducted so far on ocean deoxygenation.

Despite rising awareness, oxygen observations remain sparse, and capacity to make oxygen measurements is limited in developing countries. The goal of expanding to global scale Biogeochemical (BGC) Argo float program,[103] which support oxygen sensors, will help increase data collection within the upper 2000 m of the ocean where oxygen is most dynamic. However, significant technology transfer is needed to make and calibrate measurements and use the data. regional capacity can be improved through such programs as the first oxygen-focused GO2NE summer school run this year in Xiamen, China and the WestPac-O2NE program. Plans to create a SOCAT-like, community-based reference global and coastal dissolved oxygen data base and synthesis platform are also underway.[104] All of these activities should advance the understanding of, management for and solution space for ocean deoxygenation.

Solution Space

The mitigation of ocean deoxygenation can be addressed through international efforts to: (i) reduce the greenhouse gas and particulate (black carbon) emissions that cause atmospheric and ocean warming and partly ocean acidification; and (ii) reduce nutrient inputs to the ocean that exacerbate oxygen loss.[105] Additional solutions focusing on the adaptation angle may be developed by a. recognize that ocean deoxygenation interacts with warming and ocean acidification and impacts marine biodiversity;[106] b. alleviate direct anthropogenic stressors (e.g.; pollution, overfishing, invasive species, habitat loss, trawling or mining disturbance) that threaten resilience and increase vulnerability of marine ecosystems to deoxygenation; c. adopt spatial planning and management strategies that identify deoxygenation vulnerabilities and protect species and habitats; d. include deoxygenation as one of the stressors when assessing potential environmental impacts of projects as well as potential new plans, policies, activities or technologies at local and regional scales; e. building ocean oxygen observing capacity and expand ocean oxygen observations to improve mechanistic

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106 Breitburg DL, Salisbury J, Bernhard JM, Cai WJ, Dupont S, Doney SC, Kroeker KJ, Levin, LA, Long, WC, Milke LM and Miller SH. (2015). And on top of all that… Coping with ocean acidification in the midst of many stressors. Oceanography, 28(2), 48-61.

understanding and provide early warning systems, including by seeking to unify research collaboration across stressors, regions, disciplines, and stakeholder sectors, and f. promoting global awareness and the exchange of information about ocean deoxygenation, for example through the IOC-UNESCO's Global Ocean Oxygen Network (GO_2NE).

Ocean Acidification

The oceans have taken up about 25-30 percent of the anthropogenic carbon dioxide emitted to the atmosphere since the 1980s causing ocean surface waters to become more acidic and pH to decline by 0.17 to 0.27 pH units per decade. pH decline has exceeded natural variability in over 95 percent of the surface ocean pH already.[107] There is more variability at coastal sites thus more overlap with preindustrial conditions.[108] The impacts of acidification on the calcium carbonate pump are expected to be rapid (9–18 years for regionally integrated signals) and for the invasion of anthropogenic CO_2 into the ocean (13–26 years regionally) whereas the soft-tissue pump, which depends on nutrients supplied through circulation, emerges decades later (27–85 years regionally).[109]

In addition, the seasonal cycle of pCO_2 has increased in amplitude, especially at high latitudes, with projections for greater future amplitude of H^+ but reduced seasonal cycles of pH and aragonite saturations state.[110] Coastal waters are heavily influenced by upwelling, inputs from rivers and estuaries, and biogeochemical processes which also can alter local carbonate chemistry.[111] [112] Nutrient loading and significant freshwater inputs can contribute to conditions that corrode calcium carbonate.[113]

Ocean acidification is having a major impact on marine life from the tropics to the poles. Reductions in ocean carbonate saturation, place stress on animals that produce calcium carbonate skeletons (e.g., pteropods, shellfish, corals) and will contribute to dissolution of the non-living component of the habitat formed by skeletal rubble.[114] The disruption is fastest at high latitudes; a threshold could be crossed in the Arctic within a decade, and in the Antarctic within several decades. OA vulnerabilities are high in the Beaufort, Bering and Chuckchi Seas large commercial and subsistence fisheries occur.[115]

Understanding derived from studies of natural CO_2 gradients associated with natural seepage reveals that acidification causes loss of biodiversity (e.g., a 30 percent drop in biodiversity from pH 8.1 to 7.8), degradation of reef habitat, dominance by non -calcifying species, and reduction in size and abundance of calcifying species, leading to overall poor ecosystem status.[116] However, quantifying ocean acidification impacts remains an emerging field of study. Novel techniques are being applied to characterize the performance of calcified structures under acidification, including changes to growth, development, mechanical strength, mineral composition, and cellular biomineralization.[117] Marine species exhibit differences in their sensitivity to ocean acidification and in their potential to adapt. However, present-day saturation state (Ω_{arag}) conditions fall below biologically relevant thresholds indicated for mussel and oyster larvae in California, clams in the Gulf of Maine and for warm water coral reefs and cold water algal beds.[118,119] The combined impact of higher temperature with ocean acidification is particularly problematic for tropical corals,[120] [121] although some temperature soft corals are resilient.[122]

Monitoring to improve understanding of variability and rates of change in ocean acidification at local to global scales, combined with studies of biological impacts are central aims of the Global Ocean Acidification Observing

107 IPCC. (2019). Summary for Policymakers. In: IPCC Special Report on the Ocean and Cryosphere in a Changing Climate [H.-O. Pörtner, D.C. Roberts, V. Masson-Delmotte, P. Zhai, M. Tignor, E. Poloczanska, K. Mintenbeck, M. Nicolai, A. Okem, J. Petzold, B. Rama, N. Weyer (eds.)]. In press.

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Box 1. The International Alliance to Combat Ocean Acidification: Government Collaboratives Mobilizing Global Leadership to Advance Ocean Acidification Action Plans that Address Root Causes and Protect Coastal Communities and Livelihoods from a Changing Ocean

Examples of Leadership and Action Taking:

Under the leadership of its diverse members, The International Alliance to Combat Ocean Acidification (OA Alliance) is harnessing growing scientific knowledge about impacts of ocean acidification and transforming it into increased urgency and ambition for climate mitigation and visible and innovative actions. National, subnational, regional and tribal governments are proactively responding to the impacts of ocean acidification as they chart their course of action for sustaining coastal communities and livelihoods.

The OA Alliance was established in 2016 as an outgrowth of regional collaboration by subnational governments responding to the observed impacts of ocean acidification in the mid-2000's to oyster hatchery production across the North American West Coast. Today, over 80 members from across the globe have joined forces to take action on ocean acidification through the OA Alliance including nations, states and provinces, tribes, cities, and a wide array of affected industries, academic and research institutions, and NGOs.

Members of the OA Alliance commit to take individual actions that address the environmental, cultural and economic threat posed by ocean acidification within their region by creating an OA Action Plan. The OA Alliance has committed to deliver 20 OA action plans and to increase its membership to 100 by the end of 2019.

Tools for Policy and Decision Makers:

As described above, OA Action Plans provide a vehicle for increasing visibility of tangible climate impacts on oceans, raising urgency and ambition in the types of actions taken, motivating quicker and on-the-ground action, and elevating the ways in which ocean impacts need to be addressed across climate, economic and social frameworks .

OA Alliance members are also calling for emissions reductions and ocean adaptation and resiliency actions under international and national climate frameworks like the United Nations Framework Convention on Climate Change (UNFCCC) and the United Nations Sustainable Development Goals (particularly UN SDG 14). The best mitigation plan for ocean acidification is to drastically curb carbon dioxide emissions, which will require ongoing commitments to international collaboration across national, subnational, sovereign and civil society leaders.

Work underway through the OA Alliance has important co-benefits by targeting and advancing actions that improve adaptation and resilience of those whose food security and jobs are most at risk.

For example, New Zealand is working to protect critical aquaculture industries like the Green Shelled Mussel through strategies that help to mitigate OA impacts on mussel farms through waste shell dissolution, aeration techniques, and identifying resilient families and using stocks from selective breeding. New Zealand is also working to improve management of land-based activities in locations where economically significant marine species are most vulnerable.

Actions such as reducing local land-based pollution and protecting and restoring marine habitats will not only reduce impacts of acidification, but also minimize species extinction and ecological loss. Additionally, these marine habitats are often very effective at capturing and storing carbon.

The City of Vancouver in British Columbia, Canada launched a Blue Carbon pilot project that aims to explore how blue carbon projects can be better incorporated in city carbon accounting, conservation, development and restoration efforts and have discovered many co-benefits of the pilot project along the way.

The Secretariat of the Pacific Regional Environment Programme has been working with governments in the Pacific Region to build resilience to ocean acidification impacts. Efforts include ongoing monitoring efforts and an emphasis on identifying adaptation approaches that are community driven and focus on reducing other compounding stressors.

The OA Alliance is not alone in its efforts and has strategically identified and built relationships with strong partners and potential new members each month, ultimately securing commitments to collaborate across organizations and increasing commitments to join. The OA Alliance has been steadily increasing the number of government and affiliate members that are regularly engaged with OA Alliance efforts which provides diversity of membership from members focused on impacts from the Arctic to the Indian Ocean.

Organizations like the Global Ocean Acidification-Observing Network (GOA-ON) and the Ocean Acidification International Coordinating Center help to coordinate research that is critical for the ultimate creation of decision support tools, the OA Alliance is unique in that it specifically focuses on governmental action on the international scale.

Network (GOA-ON). As of October 2019, GOA-ON has more than 650 members from over 90 countries. The network is working with partners, i.e. the Intergovernmental Oceanographic Commission of UNESCO (IOC-UNESCO) and the Ocean Acidification International Coordination Centre of the International Atomic Energy Agency (OA-ICC of the IAEA), and the Ocean Foundation, to build capacity and awareness around the world. An integrated network of observations is also helping to understand biological impacts of ocean acidification in the context of multiple stressors, including increased temperature and lower dissolved oxygen concentrations.

The need for monitoring of ocean acidification and its impacts on marine ecosystems has been recognized at intergovernmental levels including by the UN General Assembly, the UN Convention of Law of the Sea, the Convention on Biological Diversity and the Intergovernmental Panel on Climate Change. The UN General for the SDG indicator 14.3.1) together with GOA-ON is currently coordinating the aligned reporting of Member States towards both mechanisms, SDG and Global Climate Indicator, supporting scientists and governments to translate information to action.

The Paris Agreement does not mention ocean acidification or deoxygenation or their ability to undermine the environmental pillars of sustainable development.[123] In development of nationally determined contributions to reduce emissions under the Paris agreement, fourteen countries mention ocean acidification, but only one addresses oxygen loss.[124] Actions that can lessen the impacts of ocean acidification include reduction in pollution and other stressors (to strengthen resilience); seaweed cultivation and seagrass restoration, water treatment (e.g. for high-value aquaculture); adapting human activities such as fishing and repairing damage.[125] Additional actions include the use of spatial refugia (isolated from corrosive high CO_2 conditions) and adaptive refugia, which reduce species' vulnerability to ocean acidification through intermittent exposure to low pH. In the latter case changes via physiological plasticity, epigenetics or genetics will enhance their potential to adapt to changing conditions.[126] Examples of national and sub-national level action to address the impacts of ocean acidification, led by the International Alliance to Combat Ocean Acidification, are noted in Box 1.

Multiple Stressors

Individually and in combination, nearly all climate drivers (warming, oxygen loss, ocean acidification, and sea-level rise) are altering ocean ecosystems, from the the ocean by affecting the availability of their food, their predators, the genetic connectivity of populations and their ability to survive, grow or reproduce. Warmer waters will result in less efficient and more rapid trophic transfer leading to future loss of biomass and production.[127] All of this can change species distributions across regions and with water depth, species composition, biodiversity and biomass in the ocean.[128] The loss of suitable conditions and of habitat-forming species such as corals or kelps, most pronounced in the tropical and temperate regions, means that climate change is manifested as habitat loss, which can translate into species loss. For example, many fish species are moving toward the poles or to deeper depths to get to cooler water. Humans are affected directly by loss of access to and reduced quantity of harvested or cultured fish and shellfish. Indirect effects can be detected when coastal ecosystems such as coral reefs, seagrass beds, kelp forest, and mangroves and salt marshes are altered. The changes reduce protection from storms and tsunamis, tourism, recreation and nursery grounds, as well as reduce important carbon sequestration services.

Elevated CO_2 emissions typically impose multiple forms of stress on ocean ecosystems. Coral reef ecosystems are among the hardest hit. Warming and ocean acidification cause bleaching, increased incidence of disease and reduced skeleton formation (calcification) in warm water corals, while non-living components of the reef dissolve. Human well-being and livelihoods are dependent on coral reefs in many low latitude countries in the northern and southern hemispheres; reefs provide food, jobs, income and physical protection. Pelagic fishes inhabiting the open ocean (like tuna or swordfish) are experiencing habitat compression, reduced productivity and lowered biomass (millions of tons with 2°C rise) in response to warming and oxygen loss; this will translate into reduced income to nations, and reduction of protein supplies. All of these changes interact with and exacerbate the consequences of direct human stress such as overfishing, pollution, species invasion and habitat conversion.[129]

123 Hall-Spencer J, and Harvey B. (2019). Ocean acidification impacts on coastal ecosystem services due to habitat degradation. Emerging Topics in Life Sciences, 3(2), 197–206.

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3. THE CENTRAL ROLE OF NATIONALLY DETERMINED CONTRIBUTIONS

3.1 Actions to Further Improve the Ocean Content of NDCs

In accordance with the Paris Agreement ambition cycle, Parties shall present their revised Nationally Determined Contributions (NDCs) every five years, starting in 2020. This will be followed two years later by the Global Stocktake to assess progress and inform ambition, and at the end of each cycle, Parties will report their progress under the Enhanced Transparency Framework.

With the first cycle of revised NDC submissions starting in 2020, the past year has seen Parties preparing their respective NDCs, which are due for submission to the Secretariat of the UNFCCC by March 2020, with a view to their launch at COP26 at the end of 2020. Within this context, the incorporation of possible ocean elements within NDCs has increasingly become part of the conversation.

In 2016 during COP22, the second Because the Ocean Declaration,[130] now supported by 39 countries "encourage[d] UNFCCC Parties to consider submitting NDCs 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".[131]

The first NDCs (at that time "Intended" Nationally Determined Contributions) were submitted to the UNFCCC Secretariat in 2015 and 2016, generally reflecting action for 2020 onwards. As of June 2016, 161 governments had submitted "Intended" NDCs. In a review of these, Gallo et al (2017) showed that 70 percent of NDCs (112/161) included reference to ocean, coastal, or marine issues.[132] However, while this was seen as an important recognition of the role of the ocean in national climate change action plans, NDCs varied widely in specificity and it remains to be seen if ocean-related references in NDCs translated into significant ocean-related climate action. Marine issues were more frequently included by countries as a component of their adaptation section in NDCs, than the mitigation section, suggesting that there are significant opportunities to further incorporate the carbon mitigation potential of blue carbon ecosystems and other nature-based solutions in revised NDCs.

The Because the Ocean initiative organized a series of workshops, beginning at COP23 in Bonn in 2017,[133] including regional workshops in Latin America (Santiago, Chile, October 2018),[134] Europe (Madrid, Spain, April 2019)[135] and the Pacific (Suva, Fiji, May 2019)[136] in order to explore what ocean-related measures could be incorporated within NDCs. Representatives from Parties to the Paris Agreement, intergovernmental organizations, academia and NGOs participated in the workshops, and it was agreed to consider the incorporation of ocean measures more broadly within climate strategies, including NDCs, National Adaptation Plans (NAPs), Adaptation Communications and National Policy Frameworks.

The Katowice climate change package (or Rulebook) adopted in 2018 at COP24 in Katowice, Poland, provides further implementation guidelines for the Paris Agreement on climate change, including procedures and mechanisms that will operationalize the Agreement. Some NDCs originally communicated only mitigation measures, many others communicated both mitigation and adaptation measures. The Rulebook adopted at COP24 in Katowice makes clear that adaptation can be provided in NDCs or alternatively in Adaptation Communications, NAPs or Transparency reports. However, the incorporation of adaptation measures within NDCs may also bring additional benefits as they can encourage the support of potential donors, and increase the consideration of relevant marine issues within UNFCCC processes. It would also be useful to incorporate ocean-related indicators under the Global Stocktake to help inform policy choices and ensure greater consideration of ocean issues in the development of NDCs.

A synthesis document released at the beginning of October 2019 provides a menu of options.[137] The following five key actions are discussed in the report: (1) encouraging natural carbon sequestration by coastal ecosystems; (2) developing a range of sustainable ocean-based renewable energy solutions; (3) promoting adaptation and resilience solutions for vulnerable populations, ecosystems and ecosystem services threatened by climate change; (4) implementing hybrid solutions supporting both adaptation and mitigation in the fisheries and aquaculture sector; and (5) solutions in the shipping sector.

Parties are currently preparing the submission of their NDCs in 2020 as part of the next five-year ambition cycle. Therefore, it is early to assess how the ocean will be incorporated. Some signals are encouraging, such as the early submission in 2019 of its revised NDCs by

130 https://www.becausetheocean.org/second-because-the-ocean-declaration/

131 Paragraph 3, second Because the Ocean Declaration, 2016.

132 Ocean Commitments under the Paris Agreement, Gallo, Victor, Levin, in Nature Climate Change, 2017 https://www.nature.com/articles/nclimate3422

133 https://www.becausetheocean.org/wp-content/uploads/2018/11/Bonn_workshop_COP23_Because_the_Ocean.pdf

134 https://www.becausetheocean.org/wp-content/uploads/2018/11/Santiago_workshop_ENG_Because_the_Ocean.pdf

135 https://www.becausetheocean.org/wp-content/uploads/2019/06/BTO-Madrid-Workshop-Report.pdf

136 https://www.becausetheocean.org/wp-content/uploads/2019/06/Fiji-Workshop-Report.pdf

137 https://www.becausetheocean.org/wp-content/uploads/2019/10/Ocean_for_Climate_Because_the_Ocean.pdf

the Kingdom of Tonga, which includes the creation and management of Marine Protected Areas to enhance ocean resilience to climate change. There is hope that, in light of the warnings concerning the impact of climate change on the ocean, contained in the IPCC AR5 and 1.5°C reports, as well as the IPCC Special Report on the Ocean and Cryosphere in a Changing Climate (SROCC),[138] ocean-related climate action will flourish within the next ambition cycle.

Improving transparency surrounding the writing of NDCs, and including a broader community of ocean stakeholders in the process, would likely lead to more detailed plans in NDCs regarding ocean, coastal, and marine ecosystems. Given that the analysis of ocean inclusion in NDCs has spurred attention to this issue, additional research on ocean inclusion in Adaptation Communications, NAPs, or Transparency reports would be a valuable area of science-policy research.

Recognizing that "so far there hasn't been enough discussion on what ocean-related outcomes could be identified within the UNFCCC," COP25 President and Chile's Environment Minister Carolina Schmidt explains in the preamble of the Because the Ocean report published in October 2019 that "the Chilean Presidency has decided to launch the Platform of Ocean Solutions during COP25 in Santiago, with the aim of closing that gap. The Platform [will be] a tool to stimulate our collective thinking as Parties, taking into consideration inputs from all stakeholders and using the best available science. The online Platform will remain open throughout the intersessional period leading to COP26, in order to encourage ocean action within Nationally Determined Contributions, and also within National Adaptation Plans, Adaptation Communications and other relevant national policy frameworks."

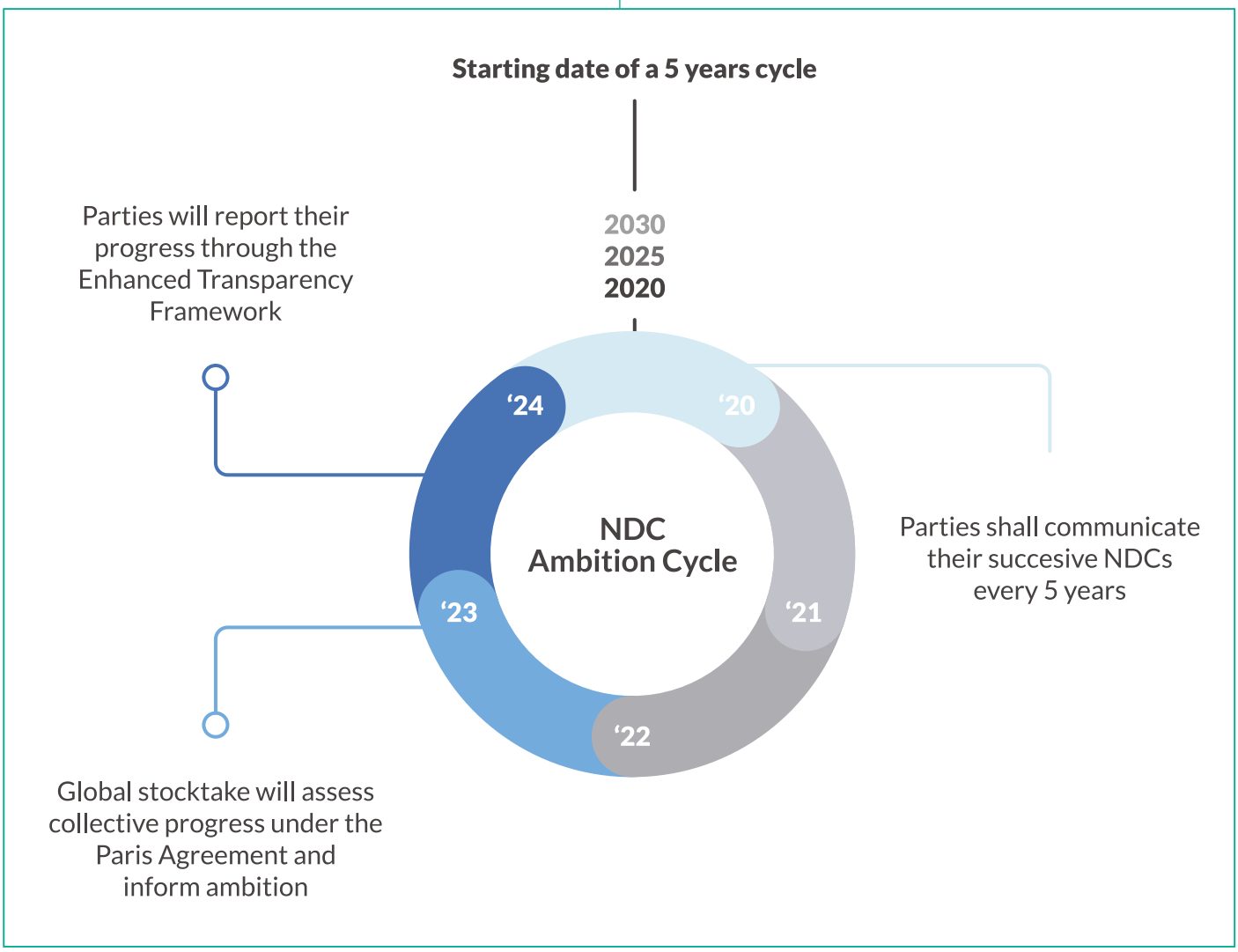


Figure 3. Paris Agreement Ambition Cycle–Based on presentations by Joanna Post, UNFCCC Secretariat, at the Madrid and Suva Because the Ocean workshops

138 https://www.ipcc.ch/srocc/download-report/

4. MITIGATION

Roadmap Recommendations: Further develop and apply mitigation measures using the oceans, such as implementing "Blue Carbon Policies," reducing CO2 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 CO2 emissions so that the Paris Agreement to limit emissions to well below 2 C can be achieved, ideally holding to 1.5 C.

4.1 Implementing "Blue Carbon" Policies and "Nature-based Solutions"

Nature has taken center stage and is now being recognized for its fundamental role in addressing climate change. The Nature-based Solutions for Climate Manifesto, developed by the governments of New Zealand and China for the UN Climate Action Summit 2019[139] highlights the role of nature-based solutions (NbS) to climate change. The conservation, protection and restoration of forests, wetlands, and grasslands could provide a third of the global emissions reduction solution by 2030 that are needed to meet the long-term goals of the Paris Agreement.[140]

The sustainable management of coastal "blue carbon" ecosystems – protecting and conserving the carbon sequestered and stored by mangroves, tidal marshes and seagrasses – as part of NbS, presents a unique opportunity to support mitigation activities, as well as climate adaptation needs. In recent years, NbS from coastal carbon ecosystems has seen continuous attention at the local, national and international scales – from policy development to project implementation and continued scientific research and observations. Key findings are summarized below:

From a global perspective, a study concluded in 2016 found that 53 percent of 163 Nationally Determined Contributions (NDCs) reviewed included various references and actions regarding coastal 'blue carbon' ecosystems within their adaptation and/or mitigation components.[141] This result did not reflect in more detail whether countries included quantifiable NbS-oriented targets. There is, however, an overall call that more concrete, evidence-based targets for NbS (including on coastal wetlands) are urgently needed.[142] As the IPCC Special Report on Oceans and the Cryosphere in a Changing Climate (SROCC) concluded, coastal blue carbon can contribute to mitigation for many nations but its global scope is modest (offset of < 2 percent of current emissions).[143] However, for some countries such as Indonesia, Mexico or Australia with large areas of mangroves, including blue carbon to the mitigation section of their NDCs represents a significant opportunity to refine the scope and targets. This would demonstrate enhanced ambition on mitigation efforts while noting the additional adaptation and resilience benefits. For example, Indonesia holds roughly 17 percent of the global coastal blue carbon reservoirs.[144] By halting destruction and restoring mangrove forests and seagrasses, Indonesia can significantly reduce emissions in their land-use sector, alongside other forest types and uses.

The NbS Manifesto, referred to above, further states, *"NBS are already being delivered, are visible and credible, and can be exponentially scaled-up if they are fully valued and receive proper investment. Action is needed now to ensure that they achieve their full potential."* Despite the contribution of 30 percent of NbS (all ecosystems) to climate mitigation to stay below 1.5C, NbS only receives 2 percent of the funding.[145] More investment, both in terms of government funding support as well as private capital, in nature-based solutions is needed to act and achieve nature's full potential for mitigating and adapting to climate change.

As briefly mentioned above, the conservation and management of coastal blue carbon ecosystems have numerous climate benefits beyond mitigation, including supporting adaptation efforts, increasing coastal resilience, and maintaining other ecosystem services that are critical to sustainable and improved livelihood systems for local communities such as food security. A new, detailed handbook on Blue Carbon and NDCs (released end of 2019) will outline guiding principles and the methodologies needed for countries to start considering how to include mangroves, seagrasses and salt marshes into NDCs. It will also provide insights on the design of related actions for mitigation purposes, as well as how to identify adaptation options. With the increased political momentum around NbS and their potential to be

139 https://wedocs.unep.org/bitstream/handle/20.500.11822/29705/190825NBSManifesto.pdf?sequence=1&isAllowed=y

140 Griscom, B. 2017. Natural climate solutions. PNAS. https://www.pnas.org/content/pnas/114/44/11645.full.pdf

141 For the specific methodology applied, please see: Herr, D. and Landis, E. (2016). Coastal blue carbon ecosystems. Opportunities for Nationally Determined Contributions. Policy Brief. Gland, Switzerland: IUCN and Washington, DC, USA: TNC. https://bluecsolutions.org/dev/wp-content/uploads/BC-NDCs_FINAL.pdf

142 Beasley, E., Schindler Murray, L., Funk, J., Lujan, B., Kasprzyk, K., Burns, D. (2019). Guide to Including Nature in Nationally Determined Contributions: A checklist of information and accounting approaches for natural climate solutions. Conservation International, The Nature Conservancy, Land Use and Climate Knowledge Initiative, Environmental Defense Fund, National Wildlife Federation, Climate Advisers, Wildlife Conservation Society, Nature4Climate. https://www.nature.org/content/dam/tnc/nature/en/documents/Guide_to_Including_Nature_in_NDCs.pdf

143 IPCC (2019). IPCC Special Report on the Ocean and Cryosphere in a Changing Climate. Chapter 5. Switzerland.

144 Alongi et al. (2016) Indonesia's blue carbon: a globally significant and vulnerable sink for seagrass and mangrove carbon https://link.springer.com/article/10.1007/s11273-015-9446-y

145 Griscom, B. 2017. Natural climate solutions. PNAS.

part of the solution for climate change mitigation and adaptation, there is an opportunity to strengthen NDCs that are being revised and resubmitted in 2020, as well as new submissions on behalf of Parties that have not yet put forward their NDCs.[146]

Other, more sectorial or ecosystem specific oriented mechanisms are reflecting the carbon value/potential for mitigation (such as national mangrove strategies or action plans), including in Abu Dhabi,[147] Ecuador,[148] Indonesia,[149] Australia, Costa Rica,[150] just to name a few.

From a conservation project point of view, successful projects are being upscaled, and new ones are emerging. While the demand for voluntary carbon credits from coastal blue carbon ecosystems seems ever increasing, only a modest amount of actual offset projects exists.

One of them being the mangrove conservation project in Vanga Bay, Kenya, which includes the sale of carbon credits on the voluntary carbon market, verified by the Plan Vivo[151] 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.[152]

Another example comes from South America. In Cispata, Colombia, the government, local communities, scientists, the private sector and international partners are working to develop the first blue carbon project to produce carbon credits related to mangrove conservation and restoration that accounts for both the plants and the soil (where 60-80 percent of the carbon value resides) using the Verified Carbon Standard. The project will result in the avoided loss of 9,600 ha of mangroves and the restoration of an additional 1,800 ha. The project is expected to generate over 1 million tons of emission reductions to be traded on the voluntary carbon market as well as through the national market driven by the countries carbon tax system. This generated carbon value will provide a significant component of the long-term financing strategy for coastal area management, sustainable ecotourism and aquaculture development, improved fishing practices in the region, and overall increased human well-being for the 12,000 people that live in the area.

Other blue carbon projects include the work of Blue Ventures in Madagascar. Here the projects focus on research to quantify the exact nature and dynamics of carbon sequestration and fluxes in Madagascar's mangroves in order to ensure the proper valuation of blue carbon credits. By maintaining strong communications with national institutions, Blue Ventures is supporting the development of mangrove conservation projects that integrate into Madagascar's national REDD+ strategy. Blue Ventures further works with communities to ensure that blue carbon projects should go beyond simply fulfilling the conditions of Free, Prior and Informed Consent, but that they should be driven and managed wholly by local stakeholders. Blue Ventures' projects are building the foundations for coastal communities to participate meaningfully in blue carbon and gain an equitable share of the benefits by engaging local management associations in project planning, management and monitoring.

IUCN's LIFE Blue Natura[153] project in the Mediterranean quantifies the carbon deposits and the sequestration rates of seagrass meadows and marsh habitats in Andalusia, with an emphasis on what is accumulated under the sediments and models their development over time to evaluate their climate mitigation potential. The project also addresses legal, policy and financing questions which can facilitate the enabling frameworks for the protection and conservation of this important habitat.

From a scientific research and carbon accounting point of view, the work of the International Blue Carbon Scientific Working Group of the Blue Carbon Initiative remains the benchmark. This group has been meeting annually since 2010 bringing together key scientists from around the world to discuss novel blue carbon research as well as identify remaining research gaps and needs that will foster science based policy-making and implementation. Its latest gathering was in Copenhagen, Denmark in September 2019. The meeting resulted in several major outcomes: First, a Nordic Blue Carbon network was formed, and the group adopted a six-month plan of activities in order to build on the momentum of the meeting. Second, at least two scientific papers are being drafted based on collaborations at the meeting: a review of the information available on Nordic blue carbon ecosystems, and a paper on the mitigation potential of macroalgae and macroalgal farming.

The scientific community is formulating other research questions in relation to, inter alia; how human activities other than those in the coastal zones influence the carbon cycle and/or release carbon back into the ocean/atmosphere, such as through bottom trawling.

146 Seddon, N., Sengupta, S., García-Espinosa, M., Hauler, I., Herr, D. and Rizvi, A.R. (2019). *Nature-based Solutions in Nationally Determined Contributions: Synthesis and recommendations for enhancing climate ambition and action by 2020.* Gland, Switzerland and Oxford, UK: IUCN and University of Oxford.

147 https://agedi.org/item/abu-dhabi-blue-carbon-demonstration-project/

148 https://www.gefblueforests.org/mangroves/mangrove-concessions-a-tool-for-conservation-with-community-participation.html

149 https://wri-indonesia.org/en/blog/promoting-indonesia-blue-carbon-agenda-achieve-development%E2%80%99s-triple-wins

150 https://www.conservation.org/projects/blue-carbon; https://panorama.solutions/en/solution/blue-carbon-z-small-projects-policy-development

151 http://www.planvivo.org/docs/VANGA-PIN_FINAL.pdf

152 https://news.gefblueforests.org/mangrove-conservation-carbon-trading-in-the-recently-launchednbspvanga-blue-forests-project

153 https://www.iucn.org/regions/mediterranean/projects/current-projects/life-blue-natura

Box 2. Blue Carbon Initiative

The Blue Carbon Initiative is a global program working to mitigate climate change through the restoration and sustainable use of coastal and marine ecosystems. The Initiative primarily focuses on mangroves, tidal marshes and seagrasses, and is also exploring the role of other carbon storing and recycling ecosystems in the coasts and oceans. The Blue Carbon Initiative brings together governments, research institutions, non-governmental organizations and communities from around the world. The Initiative is co-ordinated by Conservation International (CI), the International Union for Conservation of Nature (IUCN), and the Intergovernmental Oceanographic Commission of the United Nations Educational, Scientific, and Cultural Organization (IOC-UNESCO).

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

International Partnership for Blue Carbon

The Partnership brings together governments, research institutions and nongovernment organisations who are collaborating to enhance understanding of coastal blue carbon ecosystems.

We are coordinating efforts to increase the capacity of governments and their partners to develop and implement policies and projects. We are doing this by:

BUILDING AWARNESS in the international community of the importance of coastal blue carbon ecosystems for climate change adaptation and mitigation, and ecosystem services

SHARING KNOWLEDGE, expertise and experience to build capacity in blue carbon policy, science and practical action

ACCELERATING PRACTICAL ACTION to protect and restore coastal blue carbon ecosystems in identified priority regional 'hot-spots'

The Partnership is not a funding body, but instead aims to better connect the efforts of governments, research organisations and non-government organisations. It also aims to build on the significant initiatives already under way in this area. The Blue Carbon Initiative and its technical network serve as advisors to the Partnership.

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

Current discussions in relation to the ambition cycle in the context of the UNFCCC and its Paris Agreement see a growing interest for the ocean-related element of the climate system. Some questions related to the role of the ocean in the climate system, its contribution to the global carbon budget, and how the world's oceans are being affected by climate change remain a subject for research and systematic observation to address in the UNFCCC. However, there is an increasing recognition of the importance of nature-based solutions, including blue carbon, to make concrete and timely progress in translating the commitments under the Paris Agreement into concrete action. By including blue carbon ecosystems in climate action plans, including NDCs and other strategies, countries can demonstrate their commitment to solving the climate crisis that benefits the climate as well as communities and the environment.

4.2 Reducing CO^2 Emissions from Ships

Maritime transport is the backbone of international trade and the global economy. Around 80 percent of global trade by volume is carried by sea, and international seaborne trade has been constantly growing for the last decades, reaching 10.7 billion tonnes in 2017.[154] Carbon dioxide emissions from international shipping were estimated (2012) to be 2.2 percent of global anthropogenic emissions.[155]

Efforts to reduce GHG emissions from ships remain high on the agenda of the International Maritime Organization (IMO), the United Nations specialized agency for shipping. In April 2018, IMO adopted its initial strategy on reduction of GHG emissions from ships. It states that IMO remains committed to reducing GHG emissions from international shipping and, as a matter of urgency, aims to phase them out as soon as possible in this century.

For the first time, IMO envisages a reduction of the total annual GHG emissions from international shipping by at least 50 percent by 2050 compared to 2008, while, at the same time, pursuing efforts towards phasing them out as called for in the vision, for achieving CO_2 emissions reduction consistent with the Paris Agreement goals.[156]

Since COP24, IMO progressed the implementation of its Initial GHG Strategy with the following achievements, inter alia:

1. Approval of amendments to MARPOL Annex VI to bring forward to 2022 instead of 2025 the energy efficiency mandatory requirements for several ship types

154 UNCTAD, *Review of Maritime Transport 2018*

155 *Third IMO GHG Study 2014,* International Maritime Organization, London, UK, April 2015

156 http://www.imo.org/en/OurWork/Environment/PollutionPrevention/AirPollution/Pages/GHG-Emissions.aspx

with up to 50 percent carbon intensity reduction for largest containerships;

2. Initiation of the Fourth IMO GHG Study, which will include an inventory of global GHG emissions from international shipping from 2012 to 2018, estimates of carbon intensity of the global fleet on the same period and also in 2008, and scenarios for future international shipping emissions in the period 2018-2050. The final report of the Study is expected to be finalized by Autumn 2020;
3. Adoption of a resolution to encourage voluntary co-operation between the port and shipping sectors to contribute to reducing GHG emissions from ships. This resolution aims to promote regulatory, technical, operational and economic actions in the port sector, such as the development of Onshore Power Supply (preferably from renewable sources), the provision of bunkering of alternative low-carbon and zero-carbon fuels, the promotion of incentives promoting sustainable low-carbon shipping and the optimization of port calls, including facilitation of just-in-time arrival of ships;
4. Approval of a procedure for assessing impacts on States of candidate measures for reduction of GHG emissions from ships; and
5. Consideration of proposals to improve the operational energy efficiency of existing ships with a view to developing draft amendments to MARPOL Annex VI and associated guidelines, as appropriate.

Several important shipping private stakeholders have built on the political momentum generated by the adoption of the Initial IMO GHG Strategy. During COP24, shipping giant Maersk announced that they would target carbon neutrality by 2050. In June 2019, several major shipping banks with a combined shipping loan portfolio of USD 100bn – roughly 20 percent of the global total – have signed the "Poseidon Principles" whereby they commit to align their shipping credit products with the IMO GHG Strategy.

With the support of the European Union, IMO established and coordinates a network of five centres of expertise in developing countries called Maritime Technology Cooperation Centres (MTCCs). IMO also launched a public-private partnership called the Global Industry Alliance to support Low Carbon Shipping (GIA). In 2019, IMO launched a project resulting from the cooperation between IMO and Norway (GreenVoyage2050) to focus on testing technical solutions to reduce GHG emissions from ships and established a new trust fund aiming at providing a dedicated source of financial support for technical cooperation and capacity-building activities to support the implementation of the Initial IMO GHG Strategy.

The Initial IMO GHG Strategy identifies that technological innovation and the global introduction of alternative fuels and/or energy sources for international shipping will be integral to achieve the overall ambition. While electrification starts to finds its way in domestic shipping segments, various solutions for deep-sea shipping are being explored: biofuels including bio-LNG, hydrogen, ammonia, etc.[157] However, there are significant obstacles to global uptake, e.g. cost, volume and energy density, health and safety requirements, lifecycle emissions, storage on board and global availability in ports.

4.3 Developing Ocean-based Renewable Energy

An essential component of the world's transition from fossil fuels to renewable sources can be found in ocean and coastal environments. Factoring in the vast potential of the oceans in completing this transition opens up a multitude of new opportunities. In addition to more traditional renewable projects like wind and solar farms, researchers are investigating the potential of algal products with respect to carbon sequestration and biofuel, wave and tidal energies for coastal energy production, and floating solar panels in land-scarce regions like

157 DNV-GL, *Energy Transitions Outlook 2019, Maritime Forecast to 2050*

SIDS. Steady progress comes with the meeting of experts at conferences, dissemination of guiding publications, capacity building for high-potential areas, and deployment of innovative projects.

From February 25-27, Oceanology International Americas 2019 hosted a global audience in San Diego to showcase marine-based technologies guiding the progress of ocean observation and survey systems as they relate to security, ports and shipping, fisheries, and offshore renewable and nonrenewable energy development.[158] From May 14-16, innovative technologies related to offshore wind, tidal, and wave energy were showcased in Glasgow at the All-Energy Exhibition and Conference 2019.[159] In Orlando, industry, academia, government, and investors came together for the 2019 Algae Biomass Summit from September 16-19 to address ways in which algae can be utilized as a fuel alternative, food source, carbon capture mechanism, and raw material in manufacturing.[160]

The International Renewable Energy Agency (IRENA) has continued its efforts specifically geared towards building energy independence across Small Island Developing States. With funding from the Abu Dhabi Fund for Development, IRENA inaugurated a 10 MW solar PV project in Cuba in June 2019. More broadly, IRENA published a report in September 2019 titled "Navigating the Way to a Renewable Future: Solutions to Decarbonise Shipping."

The IRENA Lighthouses Initiative, started in 2014, has aided the 36 SIDS partners in transitioning towards a renewables-based energy sector through funding and advising on current and future projects. The Initiative has also launched an online knowledge-sharing platform so that experiences and best practices can be easily shared between nations. IRENA published the comprehensive technical guide titled "Transforming Small-Island Power Systems"[161] advising SIDS on their conversion to a more renewables-based energy sector.

Danish energy firm Orsted has made continued progress on the Hornsea One project, which will become the world's largest offshore wind farm upon completion in 2020. Located off England's Yorkshire coast, the project will power up to 1 million homes.

Meanwhile, floating solar installations are being constructed across the globe, with China leading the way. German engineering firm Swimsol GmbH is deploying both floating and roof-based solar installations across Malaysia and the Maldives.

158 http://www.oceanologyinternationalamericas.com/
159 http://www.all-energy.co.uk/Conference/2019-conference-programme/#
160 https://www.algaebiomasssummit.org/page/2019Agenda
161 https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2019/Jan/IRENA_Transforming_SIDS_Power_2018.pdf

4.4 Considering Ocean-based Carbon Capture and Storage

Carbon Capture and Storage from the IMO Perspective

The international treaty regime made up of the London Protocol and London Convention (LP/LC) provides a global, transparent control and regulatory mechanism for protecting the marine environment from all sources of pollution. Governments, through the LP/LC, have taken steps to regulate carbon capture and storage (CCS) beneath the seabed.[162] For example, long term monitoring requirements are included to help ensure the marine environment is protected from sub-seabed CCS in the centuries to come.

The LP prohibits the export of wastes or other matter for dumping in the marine environment. However, in 2009, Parties to the LP agreed an amendment to allow sub-seabed geological formations for sequestration projects to be shared across national boundaries – effectively allowing CO2 streams to be exported for CCS purposes. The CO2 export amendment to the LP is not yet in force. It needs to be formally accepted by two-thirds of the Contracting Parties to the LP, and will come into force globally just 60 days later.

4.5 EU Promotion and Development of Ocean-Related Mitigation and Adaptation

The EU is promoting and developing ocean-related action to implement the Paris Agreement, such as nature-based solutions and ocean-based renewable energy.

In 2018, the EC evaluated its 2013 Strategy on Adaptation to Climate Change. The evaluation found that climate change impacts will need to be further mainstreamed under the EU maritime and fisheries policy, and in coastal areas in general: even if emissions and temperatures stabilise, sea levels will continue to rise. One in three EU citizens lives within 50 km of the seashore and, without adaptation measures, coastal flooding will affect up to 3 million Europeans by 2050.

In November 2018, the EC adopted a new strategic vision for achieving a climate-neutral Europe by 2050.[163] It lists the overriding priorities that should guide the transition to a climate-neutral Europe. These include (i) promoting a sustainable bio-economy; (ii) diversifying agriculture, animal farming, aquaculture and forestry production, further increasing productivity while also adapting to climate change itself; (iii) preserving and restoring ecosys-

162 http://www.imo.org/en/OurWork/Environment/LCLP/EmergingIssues/CCS/PublishingImages/London%20Protocol%20Climate%20Change%20Leaflet%202019%20_FINAL_online%20version.pdf
163 Communication "A Clean Planet for all A European strategic long-term vision for a prosperous, modern, competitive and climate neutral economy" adopted on 28 November 2018, COM(2018) 773 final

tems; and (iv) ensuring sustainable use and management of natural land and aquatic and marine resources. The new strategy also describes eight scenarios indicating what needs to be done to reach the target. The analysis was based on existing and emerging technologies, thus providing assurance that the target can be achieved. Although a large focus was on energy that is responsible for 75 percent of emissions, the analysis covered the whole economy. The "Clean Planet scenarios" indicate that the oceans' contribution to achieving the decarbonisation goals will accelerate still further. Electricity consumption would double as transport, heating and industry shift from fossil fuels and a quarter of this would be generated offshore. This is as much as is being generated by fossil fuels today and twice as much as from nuclear energy. This wil bring unprecedented changes to Europe's seas with up to 15% of some Member States's waters devoted to wind turbines.

The EU is already a global leader on offshore wind energy. The revised Renewable Energy Directive[164] adopted late 2018 will further drive investment and cost reductions in this sector, and accelerate the development of ocean energy technologies. Furthermore, the clean energy for EU islands initiative,[165] launched in 2017, is specifically helping islands decarbonise their energy systems.

Reducing shipping emissions is also of prime importance in the fight against climate change. The 2018 IMO agreement on an initial strategy on reducing CO2 emissions together with ambitious targets for the maritime sector was a significant step forward. For this initial strategy to succeed, effective and substantial reduction measures are to be developed, swiftly adopted and put in place from 2023. These measures are an EU priority in the context of the IMO's regular Marine Environmental Protection Committee (MEPC).

Against this background, the EU has committed EUR 10 million[166] to establish, in cooperation with IMO, a global network of Maritime Technology Cooperation Centres in five regions: Africa, Asia, the Caribbean, Latin America and the Pacific. The objective is to help countries improve the efficiency of shipping, and thus limit and reduce greenhouse gas emissions from their shipping sectors, through technical assistance and capacity building.

Furthermore Horizon 2020 (the EU framework program for research and innovation) and its successor programme Horizon Europe (as of 2021) will support the development of the innovative solutions necessary to substantially decarbonise shipping in line with the IMO's initial CO2 reduction strategy. EUR 20 million will be invested within the final calls of Horizon 2020 to support the decarbonisation of long distance shipping.

The EU continues to develop Copernicus, its operational earth-observation programme,[167] which provides important information regarding the monitoring of the climate and the oceans as well as products useful for measuring the effects of emissions and assessing progress towards Sustainable Development Goals (e.g., ocean acidification under SDG14), in particular through the Copernicus Climate Change and Marine Services. The Copernicus Ocean State Report[168] provides an authoritative overview of the state of the oceans and serves as a reference for both policy makers and scientists.

Lastly, the EC recognised the important links between the ocean and climate at the 23rd and 24th annual conferences of the Parties to the UN Framework Convention on Climate Change (UNFCCC) by taking part in their Oceans Action Days and organising the first ever dedicated EU Oceans Action Day.

164 Directive (EU) 2018/2001 of the European Parliament and of the Council of 11 December 2018 on the promotion of the use of energy from renewable sources.

165 https://ec.europa.eu/energy/en/topics/renewable-energy/initiatives-and-events/clean-energy-eu-islands#content-heading-1

166 https://ec.europa.eu/europeaid/projects/capacity-building-climate-mitigation-maritime-shipping-industry_en

167 https://www.copernicus.eu/

168 http://marine.copernicus.eu/science-learning/ocean-state-report/

5. ADAPTATION

5.1 Actions Within and Outside of the UNFCCC

Roadmap Recommendation: 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.

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. The degree of exposure varies significantly depending upon geographic location, but overall the climatic and severe weather events that create hazardous events are intensifying and occurring with increasing frequency. Increased extreme events, such as hurricanes, and tropical storms, can be especially catastrophic, but also the longer-term, cumulative impacts of increased storminess and precipitation, such as from more frequent mid-latitude cyclones and intensified monsoon seasons, are creating subtler but nonetheless significant impacts on human activities in the world's coastal zones. These impacts include flooding of low-lying coastal areas; erosion of beaches, dunes, and cliffs; degradation of salt marshes, coastal flats, estuaries, and mangroves; and loss of productive coastal ecosystems; as 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.

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 towards and beyond 1.5ºC of global warming. 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. In Atlantic Canada, for example, the mapping of predicted coastal impacts of sea-level rise, storm surges, and storminess has been undertaken since the late 1990s, helping to plan which parts of the coastline will require the greatest efforts in terms of adaptation and mitigation. One of the most vulnerable provinces is Prince Edward Island (PEI), is where the University of PEI's Climate Lab has been mapping and assessing coastal erosion rates of 20 to 40 cm per year, and in some places over 1 metre annually. Adaptation measures are being re-designed to deal with long-term erosion acceleration.[169] Countries like the United States are not only mapping the impact of increasing sea level rise, but are using digital programs to make this information accessible to the public as well.[170] 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 could be under water within the next 15 years.[171] This would have significant impacts on the American way of life, since much of US society is reliant on internet access to sustain everyday functions.[172] India, on the other hand, has used aerial photographs to map a hazard-lines along its coast to track the vulnerability of different regions to natural hazards like storm-surges, cyclones, erosion, and tsunamis.[173] 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

169 Climate Impacts and Adaptation Science (CIAS) 2011, http://projects.upei.ca/climate/publications/climate-impacts-and-adaptation-science-cias/)

170 NOAA. (n.d.). About Digital Coast. Retrieved from https://coast.noaa.gov/digitalcoast/about/.

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

172 ibid

173 Ramesh, R., Dharmaraj, M., Varun Kumar, G., Muruganandam, R., Mary Divya Suganya, G., Sathishkumar, S., … Purvaja, R. (2018). Hazard line for the coast of India and its implications in coastal management. In Climate Change and the Vulnerable Indian Coast (pp. 11–49). New Delhi: Ministry of Environment, Forest and Climate Change.

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.

The year 2017 was one of the most devastating for highlighting the enormous effects that climate change is having on the world's coasts and the subsequent impacts upon the global population, and this has been followed by two more years of record storm events. For decades now, rising sea levels, intensification of storms, continued melting of Arctic sea-ice and permafrost, and deterioration of coral reefs have been increasing the vulnerability of our coasts and oceans to erosion, flooding and saltwater intrusion. If earlier storms such as Hurricanes Katrina in 2005 and Sandy in 2012, and Typhoon Haiyan in 2013 were not warning enough, the well-publicized impacts of the 2017 hurricane season on Caribbean, Atlantic, and Gulf coast communities have made it clear that the effects of climate change are becoming more and more obvious. With Hurricane Michael, 2018 became the third consecutive season to feature at least one Category 5 hurricane (Matthew in 2016; Irma and Maria in 2017) and Hurricane Dorian in 2019 made it four years in a row. Scientists have been warning of the catastrophic impacts that climate change is having upon the world's oceans[174,175,176] and that these impacts are cumulative over time and will continue to increase in severity. The 2017 and 2018 reports on progress on ocean and climate action[177] 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 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.[178]

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 which 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.[179] This report even provides a guidebook for coastal communities that are looking to relocate. 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.[180] According to the World Bank´s March 2018 Report, climate change could become the country's number one driver of internal migration by 2050, displacing up to 13.3 million people.[181] A similar trend

174 Schubert, R, H.-J. Schellnhuber, N. Buchmann, A. Epiney, R. Griesshammer, 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.

175 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, Blackwell Publishing, pp. 1-23.

176 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.

177 B. Cicin-Sain et al. Assessing Progress on Ocean and Climate Action: 2016-2017, A Report of the Roadmap to Oceans and Climate Action (ROCA) Initiative, and B. Cicin-Sain et al. (2018). Assessing Progress on Ocean and Climate Action: 2018, A Report of the Roadmap to Oceans and Climate Action (ROCA) Initiative

178 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.

179 Burkett, Maxine, Robert R.M. Verchick, and David Flores (2017). Reaching Higher Ground: Avenues to Secure and Manage New Land for Communities Displaced by Climate Change, Center for Progressive Reform, May 2017, Washington DC, 43p.

180 Internal Displacement Monitoring Centre. (2019). *Mid-Year Figures, Internal Displacement from January to June 2019.* (pp. 1–16).

181 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://openknowledge.worldbank.org/handle/10986/29461 License: CC BY 3.0 IGO.

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.[182,183] 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."[184]

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. Reaching a category five, Dorian became the fifth Atlantic hurricane of this strength seen in the last four years.[185] However, the Atlantic is far from the only ocean that has witnessed some significant storms during 2019. Just weeks before Dorian hit the coast of the Bahamas, 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.[186] 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.[187] 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.[188] Between 1998 and 2017, more than half a million people lost their lives due to the direct results of extreme weather events, with many low-income countries being the most affected.[189] On the west coast of the USA, prolonged and cumulative drought conditions have rendered coastal forests and grasslands extremely vulnerable to fire, with thousands of homes and properties being destroyed and with

alarming increases in fatalities as previously maritime coastal regions become more arid.

Of course, none of this compares to the catastrophic impacts being faced by low-lying small island developing states (SIDS) that are facing 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.[190] 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.[191,192] 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.[193] 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

182 Bamber, J. L., Oppenheimer, M., Kopp, R. E., Aspinall, W. P., & Cooke, R. M. (2019). Ice sheet contributions to future sea-level rise from structured expert judgment. *Proceedings of the National Academy of Sciences,* 116(23), 11195-11200.

183 Nicholls, R. J., Marinova, N., Lowe, J. A., Brown, S., Vellinga, P., De Gusmao, D., ... & Tol, R. S. (2011). Sea-level rise and its possible impacts given a 'beyond 4 C world'in the twenty-first century. *Philosophical transactions of the Royal Society A: Mathematical, physical and engineering sciences,* 369(1934), 161-181.

184 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.

185 BBC. (2019, September 9). Hurricane Dorian: Path of destruction. Retrieved from https://www.bbc.com/news/world-latin-america-49553770

186 Hollingsworth, J., Wang, S., & Ward, T. (2019, August 10). 1 million evacuated as Typhoon Lekima makes landfall. Retrieved from https://www.cnn.com/2019/08/09/asia/typhoon-lekima-china-taiwan-intl-hnk/index.html

187 BBC. (2019, March 25). Cyclone Veronica: Destructive winds and rain lash Australia. Retrieved from https://www.bbc.com/news/world-australia-47688551

188 Eckstein, D., Hutfils, M.-L., & Winges, M. (2018). *Global Climate Risk Index 2019: Who Suffers Most From Extreme Weather Events? Weather-related Loss Events in 2017 and 1998 to 2017.* Bonn: Germanwatch.

189 ibid

190 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/content/documents/2173emerging%20issues%20of%20sids.pdf)

191 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.

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

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

preparing for increasing sea level rise and nations like the Marshall Islands are considering building higher islands rather than moving.[194] In Jakarta, which is predicted to be severely impacted by sea level rise in the near future, the construction of a 25 kilometer seawall protecting the city from being submerged under water is currently underway.[195]

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,[196] 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.[197] Coral reefs are not only home to much of the regions biodiversity, they also serve as a protection against storms, reducing the cost of global storm damages by up to USD 4 billion annually.[198] 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,[199] while the recovery from cyclone Winston the following year cost Fiji 30 percent of their GDP.[200] 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.[201]

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.[202] In Canada's 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.[203] 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 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 impacts 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[204] 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.

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

195 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/

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

197 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.

198 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.

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

200 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/.

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

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

203 https://novascotia.ca/coast/

204 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.

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 Special Report on the Ocean and Cryosphere in a Changing Climate (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.[205] The report also stresses the importance of adaptation and claims that the integration of local and indigenous knowledge in adaptation efforts have been beneficial. [206] 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.[207]

The Least Developed Countries Fund (LDCF) and the Special Climate Change Fund (SCCF), established by a COP decision, responds to various guidance received from the UNFCCC COPs. They have been supporting country-driven projects that address national priorities and have been facilitating the development of initiatives with transformative potential at the global and regional levels that may be too early or risky to be rolled out at the national level, as well as enabling activities. The two funds have been the engines of a pioneering portfolio of over 330 adaptation projects and programs, with over USD1.5 billion in grant resources to date.[208]

The Global Environment Facility is working to streamline the flow of financial support to least developed countries through a new Programming Strategy on Adaptation to Climate Change for the LDCF and the SCCF and Operational Improvements July 2018 to June 2022.[209] The strategy aims to strengthen resilience and reduce vulnerability to the adverse impacts of climate change in developing countries, and support their efforts to enhance adaptive capacity. To achieve this goal, the strategy emphasizes three strategic objectives for the LDCF and SCCF: 1) Reduce vulnerability and increase resilience through innovation and technology transfer for climate change adaptation; 2) Mainstream climate change adaptation and resilience for systemic impact; and 3) Foster enabling conditions for effective and integrated climate change adaptation.[210]

205 IPCC, SROCC, 2019. Chapters 3, 3.2, 3.3; and Chapter 5, 5.2, 5.4
206 IPCC, SROCC, 2019. Section A7 SPM 16
207 IPCC, SROCC, 2019. Section 5.5.2.1
208 GEF (2018) 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. https://www.thegef.org/sites/default/files/council-meeting-documents/EN_GEF.LDCF_.SCCF_.24.03_Programming_Strategy_and_Operational_Policy_2.pdf
209 Ibid.
210 Ibid.

Investing in climate change adaptation efforts has become even more popular in recent years, 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.[211] Following the report, the World Bank, the Bill and Melinda Gates Foundation, and several governments pledged USD 790 million to increase food security and agricultural resilience around the world.[212] The United Nations Development Programme (UNDP) is also scaling up its support to climate actions across the globe through its 'Climate Promise' Program. This includes USD 3 billion in funding for climate action in over 100 countries in the next decade.[213] Furthermore, in the beginning of 2019 the European Union also pledged EUR 30.7 billion towards strengthening disaster risk management in the Caribbean.[214]

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 sports cars.[215] Since the project started, more than FJ 255 million (about USD 117 million) has been collected through the tax, which has been spent on 102 different mitigation and adaptation projects across the country.[216] Given Fiji's vulnerability to climate change, the government intends

211 Global Commission on Adaptation. (2019). *Adapt Now: A Global Call for Leadership on Climate Resiliance.*
212 World Resource Institute. (2019, September 23). RELEASE: At UN Summit, New Commitments of Over $790 Million to Support Climate Adaptation for Over 300 Million Small-Scale Food Producers. Retrieved from https://www.wri.org/news/2019/09/release-un-summit-new-commitments-over-790-million-support-climate-adaptation-over-300.
213 Hassan, H. R., & Cliff, V. (2019, September 24). For small island nations, climate change is not a threat. It's already here. Retrieved from https://www.weforum.org/agenda/2019/09/island-nations-maldives-climate-change/.
214 European Union, EEAS. (2019, January 31). Euro 30 Million to Help Caribbean Enhance Climate Resilience and Adaptation. Retrieved from https://eeas.europa.eu/delegations/guyana/57472/euro-30-million-help-caribbean-enhance-climate-resilience-and-adaptation_en.
215 Government of Fiji. (2019). ECAL in Action How Your Environment and Climate Adaptation Levy is Building a Better, Stronger Fiji. [Powerpoint slides]. Retrieved from https://www.fiji.gov.fj/getattachment/e71b8d61-ce72-48fc-bca2-eeeff2d8739b/Environment-Climate-Adaptation-Levy.aspx
216 Ibid

to start allocating a certain percentage of the ECAL revenues to the Climate Change Relocation Trust Fund which can be used in case vulnerable communities within the country need to be relocated.[217]

Canada has taken a different approach to adaptation efforts, announcing the five-year Building Regional Adaptation Capacity and Expertise (BRACE) Program (2017-2022) which is a USD 18 million initiative under the Pan-Canadian Framework on Clean Growth and Climate Change.[218] The initiative aims to provide funds to organizations, small and medium enterprises, communities, and practitioners to apply their skills and knowledge to climate change adaptation. For example, the program funded an internship program on Prince Edward Island which teaches recent graduates about adaptation and how to apply it to their host organizations. Additionally, a new USD 18.5 million climate change research centre and school to be built in St. Peter's, PEI was announced by the Government of Canada in July 2019.

The Government of India has moved to develop a national Integrated Coastal Zone Management program with funding support from The World Bank, and the first phase of that project is concluding having put in place some of the key elements necessary to support ICZM at the national, state and local levels, including the mapping of coastal ecosystems and resources, increasing resilience of mangroves, and defining and mapping a designated coastal zone for development controls.[219]

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 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.220

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.[221] 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. 39 (55) of these 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.222

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 implementation 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.[223]

Even under a climate stabilization scenario of 1.5°C, adaptation to sea-level rise remains essential in coastal areas.[224] Coastal adaptation to restore natural ecosystems, such as rebuilding coastal dunes, planting 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.225 The

217 Ibid

218 Natural Resources Canada. (2019, July 25). Building Regional Adaptation Capacity and Expertise (BRACE) Program. Retrieved from https://www.nrcan.gc.ca/climate-change/impacts-adaptations/building-regional-adaptation-capacity-and-expertise-brace-program/21324.

219 MoEFCC, (2018). Climate Change and the Vulnerable Indian Coast, Edited by Ramesh R, Bhatt J R. Ministry of Environment, Forest and Climate Change, New Dehli.

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

221 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-into-Action.-Linking-NAP-processes-and-NDCs_final_korrigiert-20180918.pdf

222 Ibid.

223 Ibid.

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

225 UNDP Climate Change Adaptation. (n.d.). Enhancing Climate Resilience

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.[226]

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.[227]

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.[228,229] A recent paper by Gattuso *et al.*[230] 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.[231] 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."[232]

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 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.[233]

of India's Coastal Communities: UNDP Climate Change Adaptation. Retrieved from https://www.adaptation-undp.org/projects/enhancing-climate-resilience-india's-coastal-communities.

226 ibid

227 UN Environment (2018) In The Gambia, building resilience to a changing climate. https://www.unenvironment.org/news-and-stories/story/gambia-building-resilience-changing-climate

228 Gallo, N., D.G. Victor, and L.A. Levin (2017) Ocean commitments under the Paris Agreement. Nature Climate Change 7:833-838.

229 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

230 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.

231 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

232 Ibid.

233 Ibid.

Finally, a recent report from Because the Ocean[234] 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 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, depends on effective mitigation."[235] 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 3).

The clear message from the 1.5ºC and the 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 in surviving the new climate regime into which the world has moved.

234 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/

235 Ibid, p.36

Box 3. UNFCCC Scoping Paper on the Topic of Adaptation Knowledge Gaps on the Ocean, Coastal areas and Ecosystems[236]

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 Subsidiary Body for Scientific and Technological Advice (SBSTA) mandate to prioritize the thematic area of the ocean under the Nairobi Work Programme (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/infrastructural approach to one that considers a multitude of options. With the evolution of Nature Based Solutions (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.

236 UNFCCC. (2019). Scoping Paper on the topic of adaptation knowledge gaps on the ocean, coastal areas and ecosystems (draft).

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, resource 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 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 Nairobi Work Programme. Thematic information on the ocean together with the good practices will be continuously available on the UNFCCC Knowledge-to-Action NWP Adaptation Knowledge Portal.[237]

237 https://www4.unfccc.int/sites/nwpstaging/Pages/Home.aspx.

5.2 Adaptation Responses in Fisheries and Aquaculture

The SROCC report singles out the fisheries and aquaculture sector as one of the human activities exposed and vulnerable to climate drivers and analyses impacts and responses, echoing the most relevant messages of the FAO Technical Paper 627 on impacts of climate change on fisheries and aquaculture – synthesis of knowledge, adaptation and mitigation options.[238] Implications for specific habitats of relevance to fisheries and aquaculture are described in the SROCC. For example, coral reefs, essential for food security in tropical areas, are experiencing significant impacts, affecting their capacity to sustain fisheries.

The report refers to the increased risk of harmful algal bloom (HAB) proliferation in coastal ecosystems and in estuaries in particular, resulting from a combination of climatic and non-climatic drivers such as eutrophication and pollution. The associated risks for natural and human systems are projected to increase, calling for more local scale monitoring programs and enhanced early warning systems to reduce the food safety risk. Moreover, even with low confidence, the report suggests that reducing pollution by nutrient inputs from human sources could reduce the risk of occurrence of HABs.

Deep sea oceans are also experiencing an increase in temperature and a decrease in oxygen and pH. The SROCC frequently refers to FAO's work,[239] concluding that while some large predators might benefit from the expected changes (e.g. the giant squid will have easier access to its prey due to the expansion of the minimum oxygen zone), trophic efficiency of food webs and carbon transfer are expected to be negatively impacted. The report identifies a large number of knowledge gaps and uncertainties regarding the trend of catches of deep sea commercial species.

The combined effects of climate stressors are expected to shape the maximum fish catch potential with patterns that are consistent with the findings of the FAO Technical paper,[627] and to alter trophic relationships as well as the resulting relative abundance of large-sized fish (predators) versus small-sized fish (forage fish). Tropical oceans are expected to undergo larger impacts than the global average, in particular central Pacific, Eastern central Atlantic and Western Indian Ocean, even though some species may show a higher resilience, for example the skipjack tuna in the Pacific. Winners in terms of catch potential correspond to areas where food security is not

238 Barange, M., Bahri, T., Beveridge, M.C.M., Cochrane, K.L., Funge-Smith, S. & Poulain, F., eds. 2018. Impacts of climate change on fisheries and aquaculture: synthesis of current knowledge, adaptation and mitigation options. FAO Fisheries and Aquaculture Technical Paper No. 627. Rome, FAO. 628 pp.

239 Levin, L., Baker, M., & Thompson, F., eds. 2018. *Deep-ocean climate change impacts on habitat, fish and fisheries*. FAO Fisheries and Aquaculture Technical Paper No. 638. Rome, FAO. 186 pp.

under significant threat (e.g. Arctic). The catchability of some species such as tuna, thornyheads, dover sole, giant squid, might increase as a result of the expansion of the oxygen minimum zone and the consequent shrinking of suitable habitats. However, the report notes that actual (realized) catches in the 21st century will depend on fishing practices and fisheries governance much more than on climate change impacts alone.

In some Western and Central Pacific island states, small-scale fisheries harvests are projected to decrease by 20 to 50 percent by 2050 (RCP 2.6 and 8.5) and overall, economic implications of climate change on fisheries

is negative in countries with low Human Development Index and is projected to be higher for tropical countries. As stated in the FAO Technical Paper, the SROCC reiterates the fact that climate change worsens non-climatic socio-economic shocks and stresses and is an obstacle to economic development.

The redistribution of fisheries resources in response to direct and indirect effects of climate change have the potential to have governance implications. Disputes and disagreements in international fisheries management have already occurred (North Atlantic mackerel, Pacific salmon) and are expected to intensify. New fishing opportunities are also arising and the number of transboundary stocks is expected to increase (46 to 60 new shared stocks in 2060 relative to 1950-2014). Appropriate responses are needed to minimize conflicts around resource allocation and management and seize the opportunity to sustainably manage these emerging fisheries. The SROCC highlights that "overfishing is the most important non-climatic driver affecting the sustainability of fisheries." It also indicates that compared to a no adaptation scenario, sound fisheries adaptation addressing species distribution shifts and rebuilding overexploited or depleted stocks could lead to an increase in global profits (154 percent), harvest (34 percent), and biomass (60 percent) in the future.

The SROCC report emphasizes institutional adaptation, highlights the importance of EbA, the use of MPAs as adaptation measures and proposes a specific adaptation framework for sea level rise (protect, accommodate, advance, retreat). However, it does underline the lack of agreement about the cost and long-term effectiveness of ecosystem-based solutions. It advocates for participatory decision-making approaches for fisheries management to address climate change impacts, the use of traditional knowledge and the inclusion of other sectors to foster adaptation. These principles recall those of the Ecosystem Approach to Fisheries and Aquaculture (EAF and EAA) advocated for by FAO over the last decades. However, the adaptation framework described in the FAO Technical Paper 627 offers a broader set of adaptation measures and tools that encompass those described in the SROCC and are relevant for different scales and contexts. It is to be noted that the FAO toolbox also refers to safety at sea of fish workers who are at the forefront of weather events that add to the risks of what is considered the world's most dangerous occupation.

Adaptation strategies must include institutional and management adaptations, measures addressing livelihoods, and measures intended to manage and mitigate risks and thereby strengthen resilience. Adaptation solutions need political commitment, stakeholder participation, technological innovation and behavioral change to succeed.

The current programme of work of FAO in Chile, Eastern Caribbean, Benguela, Mediterranean, Bangladesh, Myanmar, the Philippines, Cambodia, and Timor-Leste aims at implementing these adaptation tools and measures through extensive field work in order to identify the most suitable responses in every fishery/region. This is expected to fill in some of the gaps mentioned in the SROCC that highlight the lack of examples on governance adaptation in various social and ecological contexts. FAO field programme also looks into the factors that foster adaptation and those that hinder it, while carefully paying attention to minimizing risks of mal-adaptation.

As fuller understanding of climate change implications are still needed at the national and local levels, strengthening knowledge and awareness, on climate change in riparian and coastal communities and on the need to adapt the management and exploitation practices of fisheries and aquaculture, is an important part of the field projects. This awareness is expected to assist in the development of strong adaptation actions, their integration in national policies and their smooth implementation. The field projects also seek to overcome barriers such as weaknesses in the institutional framework (national and local) and limited application of good management practices in the sector. They include a strong fisheries and aquaculture management component, mainly based on the EAF and EAA principles and tools.

Each field project includes participatory and detailed vulnerability assessments at the regional, national, local and/or community levels to identify the areas and communities that are most at risk, with due consideration for gender and age groups. Suitable adaptation measures are identified and a sound technical basis for informing policy changes is provided. Project activities, specifically targeted to different stakeholder groups, include capacity strengthening to enable stakeholders to assess the risks posed by climate change to their livelihoods and security and to ensure robust adaptation to address those risks.

6. LOW CARBON BLUE ECONOMY

6.1 International Developments to Advance the Blue Economy Practices

The concept of the Blue Economy has been developing since its inception at the Rio+20 Conference in 2012. While some consider the Blue Economy to include any marine-adjacent industry, most parties have settled on a definition that calls for sustainable, responsible, low-carbon industries and policies that develop economic opportunities to reduce poverty and promote growth. Therefore, an example of a Blue Economy transition would include offshore renewable energy deployment, but not offshore oil and gas extraction.

In April 2019, the US Department of Energy released a comprehensive report titled "Powering the Blue Economy: Exploiting Opportunities for Marine Renewable Energy in Maritime Markets."240 Also in April, the EU released its Blue Economy Report 2019241 discussing current and emerging industries as well as exemplary case studies. In July, Envirostrat Consulting Ltd. released a report titled ENCORE and the Transition to a Blue Economy in India: From Assessment to Investment. This publication focused specifically on India and emphasizes the benefits of a more localized approach on a national and sub-national scale as opposed to a global, generalized model of a Blue Economy transition.

The 2019 Our Ocean Conference took place in Oslo from October 23-24, resulting in 370 commitments from government, academia, private sector, and NGOs totaling roughly $63 billion, of which 16% (in 81 commitments) was designated towards the development of the sustainable blue economy. Some notable commitments include the Asian Development Bank pledging a financing increase to $5 billion by 2024, and BNP pledging $1 billion by 2025 towards the ecological transition of maritime transport. Nike and Ocean Conservancy launched the Arctic Shipping Corporate Pledge, inviting businesses and industry to join them in the commitment to not ship through the Arctic Ocean shipping routes

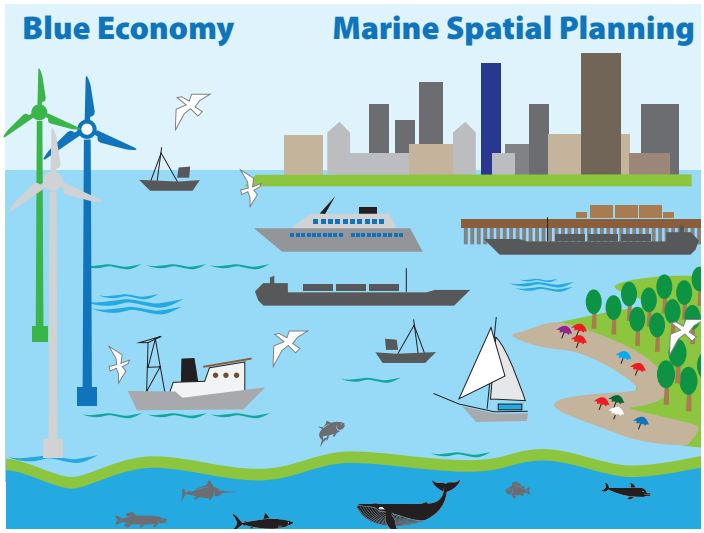
The Our Ocean Conference saw commitments from entities outside the private sector, as well. The European Commission pledged $82.5 million towards companies that contribute to lowering carbon emissions, building the circular economy and promoting ecosystem conservation. The Government of Australia pledged $47.23 million towards the Blue Economy Cooperative Research Centre, forming a science-industry partnership. The Government of Mozambique pledged $1 million to maintain the established regional platform "growing

blue" conference fostering integrated blue economy development in the WIO region. Considerable commitments also came from the governments of Argentina, Belgium, Canada, Germany, Ireland, Japan, New Zealand, Norway, Panama, Peru, the UK, and the USA.

The Global Environment Facility committed $6.8 million to the Blue Economy along the Pacific coasts of 7 Central American countries. The Ocean Foundation committed $6.8 million towards promoting a climate-resilient, sustainable Blue Economy in Latin America and the wider Caribbean Region. The Maritime Alliance announced a commitment of $100,000 over the next 12 months to develop workforce development materials, produce job profile videos, and launch a Blue Jobs website to inform youth and their parents about jobs in the growing Blue Economy. The Norwegian University of Science and Technology pledged $382,725 towards sustainable Blue Economy development of aquaculture.

The United States announced that NOAA will partner with industry, other governments, scientific institutions, and civil society organizations in the development of an Ocean Risk Index that will quantify the economic value of coastlines that are physically, biologically, and ecologically resilient.

240 https://www.energy.gov/sites/prod/files/2019/03/f61/73355.pdf
241 https://op.europa.eu/en/publication-detail/-/publication/676bbd4a-7dd9-11e9-9f05-01aa75ed71a1/language-en/



The Africa Blue Economy Forum was held in Tunis from June 25-26. Sessions focused on public-private partnerships, women empowerment in the maritime sector, fishing and aquaculture, ocean pollution, governance and security, sustainable ocean energy, ports and sustainable shipping, youth education, and innovative funding solutions.

The World Ocean Summit, hosted by The Economist Group for the 6th time, took place in Abu Dhabi from March 5-7. The African Conference on Blue Economy took place from September 10-13 at the Suez University in Egypt. On October 15, the Blue Economy Caribbean Conference was held in Miami discussing progress, financing, energy security and renewables, gender equity, and future directions. The Sustainable Ocean Summit was hosted in Paris from November 20-22. The Aquabe Conference on Aquatic Resources and Blue Economy will be held in Kochi, India, from November 28-30.

A Policy Dialogue on Blue Economy and Climate Change in the Context of Sustainable Development was held on 26-27 September in Seychelles. The policy dialogue aimed to: 1) discuss the current threats to the blue economy arising from climate change and environmental issues and challenges, which pose serious risks to the viability, sustainability and economic value of the ocean economy; 2) discuss conditions that will support the successful development of the blue economy and increase climate resilience; and 3)review measures that will enable coastal and small island States to cope effectively, creatively and sustainably with environmental changes as well mitigating impacts and threats to marine and coastal resources. The policy dialogue involved high level officials from Angola, Comoros, Madagascar, Mauritius, Mozambique, Namibia, Seychelles and South Africa, as well as representatives of regional agencies in Africa and civil society organizations.242 Another high-level policy dialogue on the "The Blue Economy, Climate Change and Environmental Sustainability" was held 19-20 November in Namibia. The two-day policy dialogue in Windhoek was aimed for stakeholders to share ideas and opportunities on the potential threats and dangers to the blue economy sector from climate change and environmental challenges.243

6.2 European Commission Work on a Sustainable Blue Economy

The EC work on a sustainable Blue Economy (i.e. ensuring sustainable use and management of marine resources, such as production of food and biomass from the sea, harnessing offshore wind, tidal and wave energy) can contribute to mitigating climate change.

Drastically reducing greenhouse gas emissions will require tapping all sources of renewable energy and accelerating the uptake of offshore renewables. Our food systems need to emit much less carbon. A shift to more mariculture and a bio-based economy would require ocean space, however, much less than the space that would be required on land. The EC will face the challenge of managing the ocean space that is required for this transition in a way that preserves marine ecosystems and ends overexploitation and biodiversity loss. The EC has the necessary governance and management tools, for example the Common Fisheries Policy, International Agreements, and Maritime Spatial Planning, which will need to be applied appropriately.

The EC puts a special focus on the blue bio-economy. It established the Blue Bioeconomy Forum, a multi-stakeholder process involving industry, public authorities, academia, finance and civil society to exploit the potential of the emerging Blue Economy and ensure sustainable use. Its results will be presented later in 2019 in the form of a "Blue Bioeconomy Roadmap." As well, the EU has emphasized the importance of financing to foster the Blue Economy. The European Commission (EC) has been working with the European Investment Bank (EIB) to create a growing "blue investment community" and set up an EU Blue Economy Investment Platform.[244] At international level, there is limited available guidance for the financial sector. With the Sustainable Blue Economy Finance Principles,[245] the EC wants to build an international coalition of financial institutions that endorses and adopts these principles on a voluntary basis, thereby supporting healthy oceans in their investment decisions and for the development of a sustainable blue economy.

242 UN Economic Commission for Africa (2019) Policy Dialogue on Blue Economy and Climate Change in the Context of Sustainable Development. https://www.uneca.org/policy-dialogue-blue-economy-climate-change-sd-2019

243 Xinhua (2019) Namibia hosts high-level policy dialogue on blue economy, climate change. http://www.xinhuanet.com/english/2019-11/19/c_138567654.htm

244 https://webgate.ec.europa.eu/maritimeforum/en/frontpage/1451

245 https://ec.europa.eu/maritimeaffairs/befp_en

7. POPULATION DISPLACEMENT

Roadmap Recommendation: Develop and support measures to address the issues associated with the displacement of coastal and island populations as a result of climate change, which will necessitate improvement of international law, in terms of clarity of definitions, rights, and procedures for migrants and people displaced in the context of climate change, including the development and implementation of appropriate financing measures.

One of the key findings of the Special Report on the Ocean and Cryosphere in a Changing Climate (SROCC) was the revised projection of the global sea level rise as a result of human-caused greenhouse gas emissions in the coming centuries. The Report indicates that with high emissions, the rise would continue to accelerate, with sea-level rise in 2100 of 15mm/year more than four times as fast as it is today (3.6mm/year), more than 10 times the rate of the last century (1.4mm/year). This would mean further sea-level rise of about 84cm by 2100, with an upper estimate of the likely range of 1.1m. As a result of climate change, coastal populations will be significantly affected by increased extreme sea level events, extreme weather events, coastal erosion, and shifts in fish distribution and decreases in their abundance and related losses in income and food security, among other impacts. Urgent response is needed to address gaps in international law, respect and recognize cultural and spiritual rights, and address the overarching need for displacement and migration to be conducted with dignity, as they are an option of last resort. There is necessity for international policy frameworks under the United Nations, notably at the level of the UNFCCC process, to ensure that issues related to human migration and displacement as a result of climate change are highlighted, defined, and action plans developed. The rights of those displaced and responsibilities of receiving countries are important, with a large gap between what is needed and what is available. Climate induced migration and displacement are lightning rod issues in the climate policy sphere, with growing recognition among the UN community, civil society, and national governments for the necessity of a proactive and coordinated solution.

The International Organization for Migration (IOM) Global Migration Indicators 2018 report shows that 68.5 million individuals were forcibly displaced worldwide due to persecution, conflict, generalized violence, human rights violations or other reasons by the end of 2017, with 258 million international migrants counted globally in 2017, representing 3.4 percent of the world's total population.[246] This report estimated that 18.8 million people in 135 countries were displaced due to environmental disasters in 2018. The majority of the movements occurred primarily within national borders, but some groups are forced to cross borders. In coastal areas, according to IPCC Fifth Assessment Report (AR5) sea level rise scenarios, without considering the potential benefits of adaptation, it is estimated that globally about 6,000 to 17,000 km^2 of land is expected to be lost during the 21st century due to enhanced coastal erosion associated with sea level rise in combination with other drivers. It is estimated that a displacement of 1.6 to 5.3 million people will be caused and associated cumulative costs is likely to be USD 300 to 1000 billion.

Climate change is predicted to increase the number of sudden-onset environmental disasters, so adequate preparation for an increase in these types of events is necessary. It is difficult, if not impossible, to attribute specific extreme natural events to climate change. In particular, sudden-onset coastal events like tropical storms and high tide flooding may occur more frequently in a high-CO2 world but it might be difficult to

Box 4. Terminology

***Retreat** reduces coastal risk by moving exposed people, assets and human activities out of the coastal hazard zone. This includes the following three forms:*

***Migration**, which is the voluntary permanent or semipermanent movement by a person at least for one year.*

***Displacement**, which refers to the involuntary and unforeseen movement of people due to environment-related impacts or political or military unrest.*

***Relocation**, also termed resettlement, managed retreat or managed realignment, which is typically initiated, supervised and implemented by governments from national to local levels and usually involves small sites and/or communities.*

by IPCC SROCC

246 Elisa Mosler Vidal & Jasper Dag Tjaden under the supervision of Frank Laczko (IOM GMDAC), 2018, Global Migration Indicators 2018, E-ISBN: 978-92-9068-772-6, Berlin, Global Migration Data Analysis Centre (GMDAC) International Organization for Migration

address displacement linked to such individual events under existing coordinating mechanisms, such as the UNFCCC Task Force on Displacement. However, there is an increasing number of studies linking individual extreme weather events to climate change as highlighted in SROCC. Slow-onset events like saltwater intrusion and loss of land due to sea level rise are more easily attributable to climate change and are easier to include in long-term loss and damage discussions.

The most recent review study on climate-induced migration identifies key features of climate-induced migration, distinguishing *slow-onset and fast-onset climatic events, direct and indirect relationship,* and *voluntary and involuntary migration.* The main finding in this review is the cause and impact of migration is contextual, depending on not only the types of climatic event but also socio-economic and political drivers. The migration outcome thus differs depending on individual or community characteristics such as wealth and gender. Based on these findings, the review concludes that the relationship between climate change and migration can be complex. While it is known that climatic events drive human migration, climate change may lead to the lack of resources and even hinder migration, which results in immobility of those who wish to migrate. The research priorities recommended in this review include future migration predictions, in particular of international migration and analysis on different migration outcome and its causes as well as case studies on the specific impact of disasters and peoples' response.[247] This year has seen the incremental number of case studies of human mobility in the Pacific region including Tuvalu, Kiribati, and Marshall Islands.[248,249,250,251]

This section also explores the mechanisms underlying the link between climate change and migration, suggesting that migration may be induced by changes in income or conflict directly and indirectly caused by climate change.[252] Although the focus of the existing debate has been highlighting the dominant "climate refugees" versus "migration-as-adaptation" discourses, seeking to better understanding how climate change and migration relate provides a broader perspective.[253]

Definitional issues will have to be further discussed and agreed upon as climate-induced migration and displacement become more frequent and affect more and more people in all parts of the word, in order to develop appropriate criteria for determining rights and protections. Climate-induced displacement is an issue of particular importance to coastal and Small Island Developing State (SIDS) populations, who are already disproportionately impacted by displacement due to environmental disasters.[254] For these populations, climate change and sea level rise are direct threats to their economies, culture, lifestyle, and the very existence of the land they have historically occupied.[255] A certain amount of climate-induced migration and displacement is now considered unavoidable, and resilience development through disaster risk reduction, climate change adaptation and mitigation efforts are becoming highly relevant for displaced persons. The conventional wisdom suggests that prioritizing mitigation, preemptive disaster risk reduction, and adaptation efforts can help avoid and reduce displacement both immediately and in the future and lessen human suffering. New research led by the Red Cross Red Crescent Climate Centre and Columbia University indicates that faster, more effective action in response to forecasts of extreme temperatures could reduce the risks and discomfort endured by five billion people in heatwaves and cold waves.[256] The new study is the first of its kind on the predictability of heatwaves and cold waves worldwide, combining that with population density to generate a map of associated risk. Climate adaptation investments in the regions found in the report can take advantage of seasonality and predictability to reduce risks to vulnerable populations.

The 20 year anniversary of the Internal Displacement

247 Cattaneo, C., Beine, M., Fröhlich, C. J., Kniveton, D., Martinez-Zarzoso, I., Mastrorillo, M., ... & Schraven, B. (2019). Human migration in the era of climate change. *Review of Environmental Economics and Policy,* 13(2), 189-206.

248 McMichael, C., Farbotko, C., & McNamara, K. E. (2019). Climate-migration responses in the Pacific region. *The Oxford Handbook of Migration Crises,* 297.

249 Fröhlich, C., & Klepp, S. (2019). Effects of climate change on migration crises in Oceania. *The Oxford Handbook of Migration Crises,* 331.

250 K van der Geest, K., Burkett, M., Fitzpatrick, J., Stege, M., & Wheeler, B. (2019). Marshallese perspectives on migration in the context of climate change.

251 Heslin, A. (2019). Climate migration and cultural preservation: the case of the marshallese diaspora. In *Loss and Damage from Climate Change* (pp. 383-391). Springer, Cham.

252 Cattaneo, C., Beine, M., Fröhlich, C. J., Kniveton, D., Martinez-Zarzoso, I., Mastrorillo, M., ... & Schraven, B. (2019). Human migration in the era of climate change. *Review of Environmental Economics and Policy,* 13(2), 189-206.

253 Wiegel, H., Boas, I., & Warner, J. (2019). A mobilities perspective on migration in the context of environmental change. *Wiley Interdisciplinary Reviews: Climate Change,* e610.

254 Elisa Mosler Vidal & Jasper Dag Tjaden under the supervision of Frank Laczko (IOM GMDAC), 2018, Global Migration Indicators 2018, E-ISBN: 978-92-9068-772-6, Berlin, Global Migration Data Analysis Centre (GMDAC) International Organization for Migration

255 https://publications.iom.int/books/climate-change-and-migration-vulnerable-countries

256 Coughlan de Perez, E., van Aalst, M., Bischiniotis, K., Mason, S., Nissan, H., Pappanberger, F., Stephens, E., Zsoter, E., and B. van den Hurk. (2018). Global predictability of temperatura extremes. Environ. Res. Lett. 13 054017

Monitoring Centre marked the release of the comprehensive Global Report on Internal Displacement 2018,[257] citing that 61 percent of new internal displacements were triggered by disasters, and highlighting that beyond the need to improve humanitarian responses to these crises, more investments must be made at the national and international levels in sustainable development, peacebuilding, addressing the impacts of climate change and disaster risk reduction.

Progress and Ways Forward Within the UN Process

The aforementioned IOM, an intergovernmental organization of the UN system, acts with its partners in the international community to assist in meeting the policy and operational challenges of migration, including issues related to environmental and climate migration. IOM works at global, regional and national levels to support states to integrate migration concerns in environmental and climate change policies and vice versa, to foster the inclusion of environmental and climate change aspects in migration policies. The organization also works at the operational levels to provide assistance to migrants affected by the adverse impacts of climate and environmental change, including the impacts on oceans. Oceans-related dimensions are of great relevance to better understanding and taking action on environmental migration. IOM regularly produces and releases global, regional and national analysis of challenges and opportunities linked to environmental and climate change in different parts of the world and over 150 publications on the topic are available.[258] Two examples of relevance to environmental migration and the link to oceans are the IOM Pacific Strategy: 2017-2020 in 2017, discussed in detail in the 2016-2017 ROCA Progress Report and the 2019 publication on climate change and migration in vulnerable countries, including SIDS.[259] In addition to the aforementioned Global Migration Indicators 2018 report, the IOM also released the ninth of the World Migration Report series, titled, The World Migration Report 2018,[260] which is focused on longer-term contributions to fostering a better and more balanced understanding of migrants and migration. IOM also released a guide titled *Migration and the 2030 Agenda: A Guide for Practitioners* to establish standards for integrating migration aspects into the SDG planning and reporting process. Finally, IOM is instrumental in supporting global and regional policy dialogues with an environmental migration dimension, notably through its engagement in the UNFCCC, especially its Task Force on Displacement and the development, follow up and implementation of the United Nations Global Compact for Safe, Orderly and Regular Migration.[261]

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The United Nations Office for Disaster Risk Reduction (UNISDR) has shifted increasing support and attention toward managing the risk of climate-induced displacement and migration in recent years through the Sendai Framework on Disaster Risk Reduction 2015-2030. The Sendai Framework places the focus on risk reduction, rather than after-the-fact disaster management, and emphasizes risk reduction across all sectors. In 2018, UNISDR had one Dialogue on disaster risk reduction in February, several Urban Risk Reduction and Resilience meetings throughout 2018, and Country Work Programme Workshops in Barbados, Saint Lucia, and Antigua and Barbuda.

A new edition of the Technical guidance for monitoring and reporting on progress in achieving the global targets of the Sendai Framework for Disaster Risk Reduction was released in March 2018. The purpose of the document is to support the refinement and finalization of the technical guidance for countries reporting on the indicators to monitor achievement of the global targets of the Sendai Framework for Disaster Risk Reduction 2015-2030.[262] January 2018 marked the start of the Sendai Framework Monitor training, with 61 countries beginning to use the Sendai Framework Monitor (SFM) to monitor progress on implementing the global plan to reduce disaster losses by 2030.

To further highlight the growing importance of this issue, the President of the 72nd session of the UN General Assembly, Miroslav Lajcák of Slovakia said in New York at the Organizational Session six of the Ad Hoc Open-Ended Working Group entitled Towards a Global Pact for the Environment, "Millions of people are living through extreme-weather events, from mega-hurricanes to droughts. And many others have lost their lives because of them."

257 http://www.internal-displacement.org/global-report/grid2018/downloads/2018-GRID.pdf

258 IOM environmental migration research database (https://environmental-migration.iom.int/research-database)

259 https://publications.iom.int/books/climate-change-and-migration-vulnerable-countries

260 https://publications.iom.int/system/files/pdf/wmr_2018_en.pdf

261 https://environmentalmigration.iom.int/10-key-takeaways-gcm-environmental-migration

262 https://www.unisdr.org/we/inform/publications/54970

In September 2016, the United Nation General Assembly adopted the New York Declaration for Refugees and Migrants, which contained strong commitments to proactive global governance on migration and established a set of common international norms and principles for migration. A key event regarding climate-induced displacement was a high-level side event held at UNGA's 73rd high-level week on 26 September 2018 to prepare for the upcoming Intergovernmental Conference on International Migration, which is being planned pursuant to the New York Declaration.[263] UN Member States agreed to cooperate on the elaboration of a Global Compact for Safe, Orderly and Regular Migration (GCM) and a Global Compact on Refugees (GCR). The GCM was adopted at an Intergovernmental Conference to Adopt the Global Compact for Safe, Orderly and Regular Migration held on December 10 and 11, 2018 in Morocco.[264] The final draft of the Compact sets out 23 objectives for safe, orderly and regular migration, the first of which commits UN Member States to "collect and utilize accurate and disaggregated data as a basis for evidence-based policies," and to develop a global program on migration data capacity-building. The Resolution adopted by the New York Declaration for Refugees and Migrants plans for the third High-level Dialogue on International Migration and Development, to be held in New York, no later than 2019 to 2020, with a role envisaged for the High-level Dialogue in the process.

The International Law and Sea Level Rise Committee, which was established by the International Law Association Executive Council in November 2012, focuses on the protection of persons displaced in the context of sea level rise as one of its priority areas. Its 2018 report proposed 12 principles with commentary comprising a "Declaration of Principles on the Protection of Persons Displaced in the Context of Sea Level Rise," that identifies tools required to assist affected persons to remain in their home, as well as to migrate within and across countries. With respect to legal perspective of human mobility and sea level rise, another report was considered at the seventy-third session of the UNGA Six Committee's International Law Commission. It clearly indicated that issues related to the protection of persons affected by sea-level rise should be considered as a major topic to be addressed. In August, 2018, the Committee on International Law and Sea Level Rise of the International Law Association issued the Sydney Declaration highlighting the Principles which apply to all forms of human mobility arising in the context of sea level rise, calling for primary duty and responsibility of States to protect and assist affected persons.

In October 2018, the United Nations Office for Disaster Risk published a report[265] that stated that economic losses caused by climate-related disasters have soared over the past two decades. In the 20-year period from 1998 to 2017, the cost associated with climate change related disasters has skyrocketed to USD 2.25 trillion. The staggering cost of climate related disasters are not just infrastructure related but also cause major human suffering through the displacement of coastal and island populations. A report released from the World Bank Group, Groundswell: Preparing for Internal Climate Migration[266] focuses on "the nexus between slow-onset climate change impacts, internal migration patterns and development in…Sub-Saharan Africa, South Asia, and Latin America," highlighting the global action that will need to take place to ward off a worst case scenario that could see climate impacts displacing as many as 140 million people within their own borders by 2050.

National, Regional, and Civil Society Initiatives

The Nansen Initiative: An Agenda for the Protection of Cross-Border Displaced Persons in the Context of Disasters and Climate Change, was approved in 2015 by a global consultation of 109 national delegates. In May 2016, the Platform on Disaster Displacement (PDD) was created at the World Humanitarian Summit as a follow up to the Nansen Initiative Protection Agenda. The PDD steering committee adopted a 2016-2019 Strategic Framework and Workplan in January 2017, with priorities to build up knowledge on displacement, to promote best practices to reduce risks and protect displaced persons, to bring the topic to public awareness and the mainstream policy process across all levels of government, and to support policies that fill protection gaps. The PDD had an ambitious timeline set for 2018 in the Workplan, and followed through on many of its objectives. These activities included pilot profiling exercises in two disaster situations, research on disaster displacement and protection gaps in the context of slow-onset and extreme events associated with the adverse effects of climate change at the regional level, review and improvement of disaster displacement profiling tools and indicators, research on gender and social equity perspectives on disaster displacement in the Mekong Delta, and participation in both the WIM Task Force on Displacement and WIM Expert Group on non- economic losses.[267] Additionally, France serves as the current Chair of PDD, and Fiji serves as the Vice-Chair.[268]

The PDD has facilitated extensive interactions with

263 https://refugeesmigrants.un.org/intergovernmental-conference-2018
264 ibid
265 https://www.preventionweb.net/publications/view/61119
266 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://openknowledge.worldbank.org/handle/10986/29461 License: CC BY 3.0 IGO.
267 https://disasterdisplacement.org/wp-content/uploads/2015/02/15012017-PDD-Workplan.pdf
268 https://disasterdisplacement.org/about-us/the-chair-and-vice-chair

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various UN groups to enhance collaborations on climate displacement issues. The PDD facilitated sessions on 'Preventing and addressing disaster displacement' during the Humanitarian Networks and Partnerships Week (HNPW) Inter-Network Day organized by the UN Office for the Coordination of Humanitarian Affairs in Geneva, Switzerland, which highlighted the current lack of disaster displacement data.[269] The PDD, in collaboration with IOM and the Government of Fiji, organized a regional capacity building workshop for Pacific Islands on *Human Mobility in the Context of Disasters and Climate Change*, offering regional policymakers the opportunity to strengthen their understanding of key issues around human mobility in the context of disasters and climate change and to discuss potential solutions at regional and national levels.[270]

At the national level, according to an IMO study, out of 66 countries and territories reviewed, 53 percent make reference to climate change and environmental factors in their national migration and displacement frameworks. Out of 37 countries and territories having submitted national adaptation policies, plans or strategies, 81 percent refer to human mobility. Out of 193 countries and territories having submitted INDCs, 20 percent refer to human mobility. The national policies are being enhanced on human mobility dimension, however, related financing still relatively weak. There is no explicit guidance on human mobility within the Green Climate Fund (GCF). However, there are currently 21 GCF projects with human mobility elements included, which were developed based on respective national policies. There are also concrete national guidelines being developed for internal relocation such as the Planned Relocation Guidelines by the Government of Fiji approved in 2018. It is a framework to undertake climate change related relocation, following a six-year-long consultative process with affected communities, government representatives and non-State actors, and it is hoped to support a human rights-based planned relocation process in Fiji.

An event titled *Addressing the Needs of Persons Moving in the Context of Disasters and Climate Change* in the Global Compact for Migration was hosted by PDD in March 2018, helping to enhance the draft text being discussed at the 3rd round of the intergovernmental negotiations on the GCM in March.[271] Additionally, a side-event was hosted at the Asian Ministerial Conference on Disaster Risk Reduction (AMCDRR) in July 2018, directly following the displacement-related side-event hosted by the International Federation for the Red Cross (IFRC) titled *Disaster Risk Reduction and Displacement: The Importance of Local Actors and Local Action*, which highlighted the role of local actors in addressing the

269 https://disasterdisplacement.org/together-at-the-humanitarian-network-and-partnerships-week

270 https://disasterdisplacement.org/pacific-region-discusses-links-between-human-mobility-environment-and-climate-change

271 https://disasterdisplacement.org/addressing-the-needs-of-persons-moving-in-the-context-of-disasters-and-climate-change-in-the-global-compact-for-migration

challenges associated with disaster displacement.[272] This multitude of workshops and events held by the PDD in 2018 makes it evident that displacement is increasingly becoming an action item on the local, regional, national, and global level.

The International Federation of Red Cross and Red Crescent Societies (IFRC) is committed to addressing the needs and vulnerability of migrants in order to provide protection and assistance through the Red Cross Red Crescent Climate Centre.[273] In 2018, the Climate Centre played many roles in the protection of the vulnerable. The Centre deployed disaster response teams to areas such Madagascar, New Caledonia, and Mongolia after climate induced disasters, and has been a key player in the politics of displacement, from the submission of a 'Talanoa' to the Talanoa Dialogue Process, to being named a key partner in the UAE global Climate Project to reduce risk. IFRC contributed to the science of displacement through the development of climate attribution science for disaster preparedness, and the work of IFRC scientists on the IPPCC assessment of global climate (AR6), as well as the release of the *World Disasters Report 2018,*[274] putting forward a series of recommendations focused on vulnerable communities from the humanitarian perspective, designed for both humanitarians and policy makers

Displacement Solutions, a nonprofit organization working closely with UN humanitarian efforts, has ramped up its actions in the last few years. Throughout 2018, Displacement Solutions released a series of publications with a strong focus on Myanmar, ranked second out of 187 countries in the Global Climate Risk Index for vulnerability to climatic natural disasters.[275] They produced a report on *Housing, Land and Property Rights and Peace Agreements: Guidance for the Myanmar Peace Process,*[276] exploring how housing, land and property rights issues have been addressed in peace agreements concluded over the past three decades and practical guidance for peace negotiators in Myanmar, as well as a publication titled *Ten Years of DS Efforts on Housing, Land and Property Rights in Myanmar-An Overview*.[277] The Displacement Solutions Myanmar Climate Land Bank (MNCLB) report of May 2017, referenced in the ROCA Progress Report for 2016 and 2017, was followed up with an article published by the OpenGlobalRights.[278] The nonprofit also focused on countries such as Syria, through an informative UN speech, and Bangladesh through land parcel purchases for disadvantaged and displaced families. Australia has been a focus in 2018, through the report on *Australia's Torres Strait Islands and Climate Displacement,*[279] which explores the effects of climate change and rising sea levels on one of Australia most vulnerable communities, and how the Peninsula Principles could be used to guide local and national law and policy to ensure that the rights of Torres Strait Islanders are fully ensured in the context of ever worsening climate change effects there.

Developments Within the UNFCCC

Since 2009, states convening under the UNFCCC have recognized the importance of addressing displaced environmental refugees. There is particular vulnerability involved with PSIDS, who have taken on a leadership role in the recent UNFCCC processes, through the Presidency of Fiji hosting COP23 to the implementation of the Talanoa Dialogue.

The Warsaw International Mechanism (WIM) for Loss and Damage associated with Climate Change Impacts was established at COP 19 (November 2013) in Warsaw, Poland, to address loss and damage associated with impacts of climate change, including extreme events and slow onset events, in developing countries that are particularly vulnerable to the adverse effects of climate change. The Executive Committee of the Warsaw International Mechanism for Loss and Damage (Excom/WIM) is currently the primary discussion place to consider climate-related migration and displacement issues within the UNFCCC. In particular, the Excom/WIM hosts a Task Force on displacement, established at COP21 to consider climate related migration and displacement, developed and finalized recommendations for the WIM Excom in October 2018.[280] These recommendations based on the stakeholder consultation were considered at COP24. The recommendations of the Task Force on Displacement were adopted by states parties to the UNFCCC in Decision 10/CP.24,[281] firmly anchoring migration and displacement issues in the official work programme of the UNFCCC. These are highlighted below. In parallel, the UNFCCC, through the regular work programme of the Executive Committee of the Warsaw International Mechanism (Excom/WIM), is engaged in an intensive programme of work pertaining to climate change and migration.[282]

The Excom held its seventh meeting in from March 13 to 16 in Bonn, Germany,[283] and its eighth meeting from 18 to 21 September 2018. The 7th meeting took note of

272 https://disasterdisplacement.org/2018-amcdrr-side-event-addressing-human-mobility-and-displacement-in-natioanl-drr-strategies
273 https://www.climatecentre.org
274 https://media.ifrc.org/ifrc/world-disaster-report-2018/
275 https://www.openglobalrights.org/climate-land-banks-addressing-displacement-in-myanmar-and-beyond/
276 http://displacementsolutions.org/wp-content/uploads/2018/03/HLP-Rights-and-Peace-Agreements-Guidance-for-Peace-Negotiators-in-Myanmar-1.pdf
277 http://displacementsolutions.org/wp-content/uploads/2018/06/An-Overview-of-DS-work-on-HLP-Rights-in-Myanmar-2009-2018-1.pdf
278 https://www.openglobalrights.org/climate-land-banks-addressing-displacement-in-myanmar-and-beyond/
279 http://displacementsolutions.org/wp-content/uploads/2018/06/Torres-Strait-Islands-and-Climate-Displacement.pdf
280 https://unfccc.int/sites/default/files/resource/2018_TFD_report_17_Sep.pdf
281 https://unfccc.int/documents/193360
282 https://unfccc.int/sites/default/files/resource/Detailed%20workplan%20by%20strategic%20workstreams.pdf
283 https://unfccc.int/node/39764


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reporting from the Task Force on Displacement (Box 6), focused on work related to slow onset events, and agreed on the general scope of a joint policy brief with the Technology Executive Committee, including a joint working group to showcase progress on the collaboration at COP24. After the eighth meeting, the Excom invited Parties and relevant non-Party organizations to identify sources of financial support to enable aversion and minimization of displacement.[284]

The 2018 May Climate Conference in Bonn included a Suva Expert Dialogue on the Warsaw Mechanism on May 2 and 3, 2018, which saw historic decision making for loss and damage, correlating with the 5 year anniversary of the Warsaw International Mechanism.[285] The Suva Dialogue was created for countries to share views on how to minimize and address loss and damage, with a focus on developing countries and SIDS. Participants in the Dialogue drafted a table summarizing potential sources of support to minimize, mitigation, and address loss and damage due to climate change.[286] Ultimately, the group will prepare a technical paper. In preparation for this paper, the highlighted key issues around risk assessments, reduction, transfer, and management. Both the Excom and the participants in the Suva Dialogue highlighted the need for enhanced communications and collaboration among UN organizations that are addressing displacement issues, as well as the need for clear and user-friendly communication tools with populations at risk for climate-induced displacement. At COP24 in December 2018, there was 17 events focused on disaster displacement related topics, showing the growing importance and recognition of climate induced displacement within the UNFCCC process.[287] One event was organized by IOM and PDD on behalf of the Wim/Excom and presented the recommendations of the Task Force on Displacement to the COP attendees.[288] At Oceans Action Day, taking place on Saturday, December 8 2018, an adaptation and population displacement panel discussed the importance of preparedness, and it was noted that displacement is about adaptation, mitigation, loss and damage, and finance and capacity development. A representative from the Secretariat of the Pacific Regional Environment Programme (SPREP) said that more progress is needed on the issue of loss and damage within the UNFCCC negotiations. Pacific island countries have developed integrated approaches to waste management, biodiversity conservation, climate change and displacement. He called for urgent action to address the stress placed on large ocean states from the threats posed by ocean acidification, and sea-level and temperature rise. A representative from the PDD, stated that the recommendations of the Task Force on Displacement under the Warsaw International Mechanism for Loss and Damage need to be situated in a network of policy areas, and expressed hope that the COP would adopt a related draft decision. IOM stressed the complicated issue of connecting human mobility with climate change and oceans, and highlighted the need for a common language addressing the importance of oceans in the human mobility domain. In the discussion, participants considered how to, *inter alia*: Broaden the discussions on climate and ocean action to include other sectors, such as migration and human mobility; translate the science into concrete policy and action; and carry out better risk assessment of climate change in coastal areas by examining "tipping points" for populations to be relocated.[289]

The IPCC Special Report on Global Warming of 1.5°C presented a dire warning about the urgency of limiting warming to decrease the amount of unavoidable climate-induced displacement.[290] The report indicates high

284 https://unfccc.int/process-and-meetings/bodies/constituted-bodies/executive-committee-of-the-warsaw-international-mechanism-for-loss-and-damage-wim-excom/workshops-meetings/excom8

285 https://unfccc.int/process-and-meetings/conferences/bonn-climate-change-conference-april-2018/events-and-schedules/mandated-events/mandated-events-during-sb-48/suva-expert-dialogue

286 UNFCCC. Report of the Suva Expert Dialogue. Bonn: UNFCCC, 2018. https://unfccc.int/sites/default/files/resource/SUVA%20Report_ver_13_Nov.pdf

287 https://disasterdisplacement.org/disaster-displacement-at-cop24-and-migration-week

288 https://environmentalmigration.iom.int/human-mobility-cop24

289 http://enb.iisd.org/climate/cop24/oceans-action-day/html/enbplus-186num15e.html

290 IPCC, 2018: Global warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty [V. Masson-Delmotte, P. Zhai, H. O. Pörtner, D. Roberts, J. Skea, P.R. Shukla, A. Pirani, W. Moufouma-Okia, C. Péan, R. Pidcock, S. Connors, J. B. R. Matthews, Y. Chen, X. Zhou, M. I. Gomis, E. Lonnoy, T. Maycock, M. Tignor, T. Waterfield (eds.)]. In Press.

agreement that the impacts of 1.5°C of climate warming would disproportionately affect disadvantaged and vulnerable populations through population displacement, among other effects. Global mean sea level rise is projected to be around 0.1 metre lower by 2100 with global warming of 1.5°C compared to 2°C. The report also confirms that sea level will continue to rise well beyond 2100, and a slower rate of sea level rise enables greater opportunities for adaptation in ecological systems and avoidance of the loss of human lives and livelihoods in small islands, low-lying coastal areas and deltas.[291] The same report points out that the understanding of the linkages of 1.5°C and 2°C on human migration are limited, and this also indicates the challenge of overall knowledge gap on climate-induced displacement and migration.

Conclusions

While migration and displacement challenges are urgent and unprecedented, they coincide with an era of unprecedented innovation and technological change. The numerous UN and civil society events held around climate-induced displacement indicate enhanced public and institutional awareness of the issue. Research indicates that ambitious mitigation of warming can greatly reduce the risk of large-scale displacement, while also indicating that a certain amount of displacement is inevitable even if emissions are peaked as soon as 2010. It is imperative that the international community work together on a proactive, comprehensive and coordinated response.

Box 5. Recommendations to the WIM Excom by Task Force on Displacement

An important development in the ongoing development of the global governance of climate migration[1] took place at the latest Conference of the Parties to the United Nations Framework Convention on Climate Change (COP24–UNFCCC), in Katowice, Poland, December 2018. States Parties to the UNFCCC adopted in COP Decision 10/CP.24 the *Recommendations from the report of the Executive Committee of the Warsaw International Mechanism for Loss and Damage Associated with Climate Change Impacts on integrated approaches to averting, minimizing and addressing displacement related to the adverse impacts of climate change.* The recommendations have a wide focus and go beyond the notion of displacement. They refer to the whole spectrum of human mobility: voluntary migration, displacement and planned relocation (paragraph (c)). This comprehensive approach highlights that different types of migration occur, often concurrently, in the context of intensified climate change impacts and that it is difficult to classify movements in neat categories. The recommendations offer practical solutions that are relevant in a wide range of circumstances, and that can be taken forward by different relevant actors (states, United Nations system, and civil society).

The Task Force encourages the Executive Committee, at its next meeting (Excom 9) to consider steps to take forward inter alia the following:

(a) Ensure that synergies are built between the strategic workstream on human mobility and the other workstreams of the Executive Committee's five-year rolling work plan, to advance work on displacement in the context of slow onset events, non-economic losses, comprehensive risk management approaches, and action and support;

(b) Include civil society, experts, affected communities as well as other relevant stakeholders on displacement, and the broader area of human mobility, in the context of climate change in the activities of the Executive Committee;

(c) In collaboration with relevant organizations, compile existing knowledge, data, tools and guidance; and develop these in gap areas where appropriate, in particular in relation to integrated approaches to avert, minimize and address displacement and broader areas of human mobility related to the adverse impacts of climate change; and disseminate them, including through the UNFCCC website;

(d) Facilitate action and support for developing country Parties efforts, as appropriate, to integrate approaches to avert, minimize and address displacement related to the adverse impacts of climate change into relevant national planning processes, including the process to formulate and implement National Adaptation Plans (NAPs).

(e) In collaboration with relevant bodies under the Convention and the Paris Agreement and relevant organizations as appropriate, facilitate capacity-building of developing country Parties related to mapping of risks of displacement, and identification and implementation of integrated approaches to avert, minimize and address displacement related to the adverse impacts of climate change;

(f) Facilitate enhanced understanding and the provision of technical support for developing country Parties to bridge knowledge and capacity gaps regarding in particular to internal displacement related to the adverse effects of climate change.

291 http://www.ipcc.ch/pdf/special-reports/sr15/sr15_spm_final.pdf

8. FINANCING ON OCEANS AND CLIMATE

8.1 Financing on Oceans and Climate

Roadmap Recommendation: Adaptation and mitigation efforts in coastal and SIDS contries/ 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 Need to Track Financing of Ocean Conservation and Climate Action

Previous releases of ROCA suggested jointly considering the costs of ocean conservation and climate action (i.e. mitigation and/or adaptation efforts), and the need for financing both simultaneously, particularly in lower-income coastal or small island states.[292] Scholars have begun to study ocean financing needs and mechanisms, particularly as part of the efforts to track progress toward meeting the targets for SDG14.[293] Such efforts could include tracking grants and concessional investments provided by public institutions operating at the national or international level, i.e. public financing, as well as private capital provided with at least some intention of contributing to these societal goals, e.g. impact investment.

Towards the Tracking of Public Financing of Ocean Conservation and Climate Action

To contribute to efforts to track public financing of ocean conservation and climate action, ROCA associates at Duke University, John Virdin and Tibor Veigh, have established a baseline for three international institutions operating at the global level: the Global Environment Facility (GEF), the Green Climate Fund (GCF) and the World Bank. This baseline provides a snapshot in time (from 2013 to 2017) of public financing from these global institutions, provided to governments and stakeholders in coastal or SIDS countries.

As a result of searches via publicly available project databases for the three organizations, we estimate that total public financing (or aid) from the GCF, GEF and World Bank to support ocean conservation and climate action increased from just over USD 500 million in 2013, to over USD 2 billion in 2017. The funding largely targeted SDG 13.1 (coastal population adaptation), followed by SDG 14.2 (ecosystem management) and 14.4 (fisheries) (see Figure 4).

292 Cicin-Sain et al. 2018. Assessing Progress on Ocean and Climate Action 2018.

293 Wabnitz, CC and R Blasiak. 2019. The rapidly changing world of ocean finance. Marine Policy 107: https://doi.org/10.1016/j.marpol.2019.103526

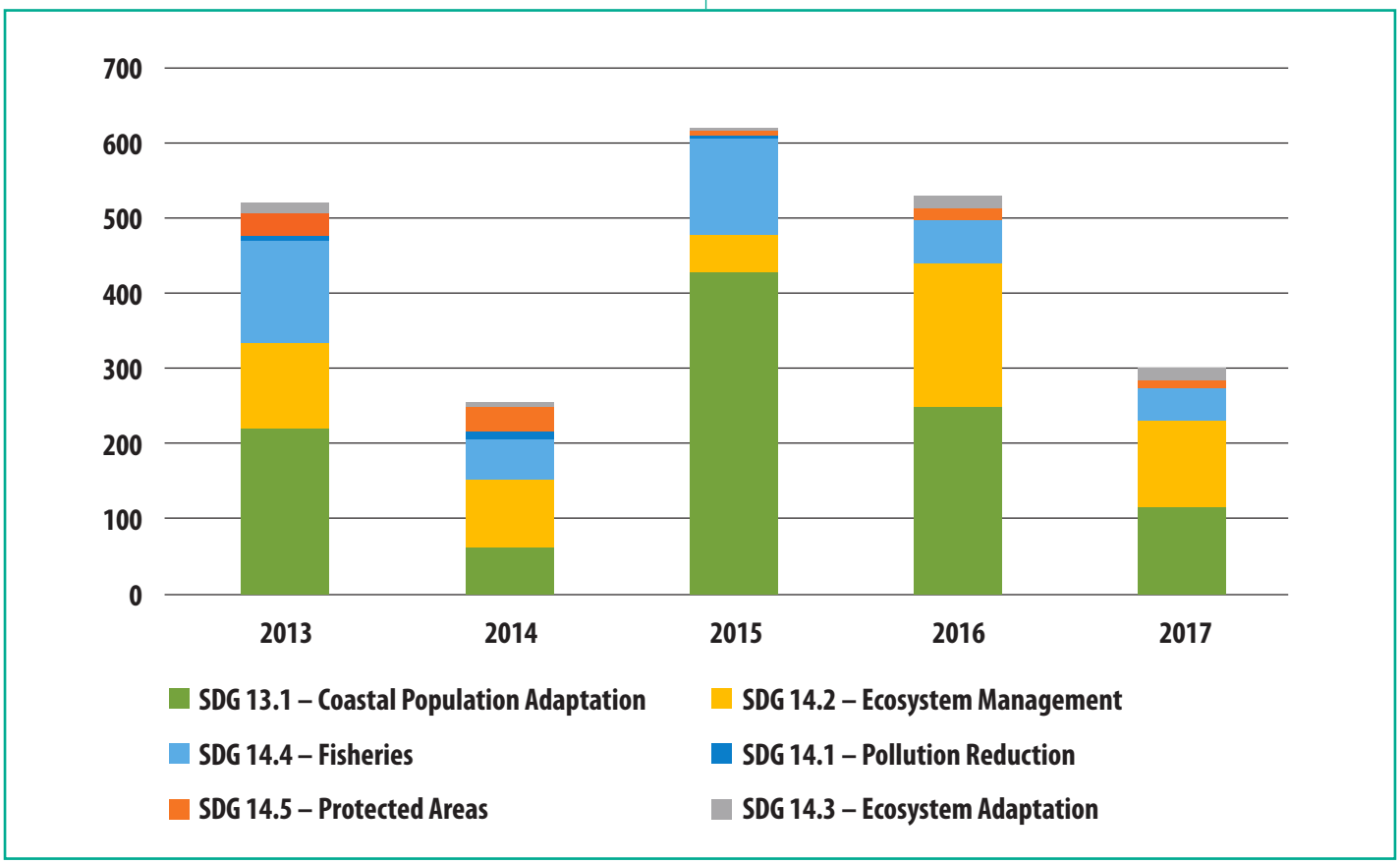


Figure 4: Estimated 2013-2017 Financing from the GCF, GEF and World Bank, by SDG Target (USD million)

More specifically, searches of the Green Climate Fund (GCF, 2015 to 2017) identified a total of 15 projects (out of 96 GCF projects in total) supporting ocean conservation and climate action in some form, for a total of USD 414.3 million (average USD 20.7 million, over 5.5 years). Roughly 90 percent of these projects aimed to help coastal populations adapt to climate-related impacts for a total of USD 372.5 million. From 2013 to 2017 a total of 126 Global Environment Facility (GEF) projects, with an average amount of funding for ocean conservation and climate action per project of USD 3.5 million, were identified, for a total of USD 571.6 million. One fifth of these projects aimed to enhance coastal population adaptation for a total of USD116 million. During this same time period the World Bank approved a total of 17 projects identified in the search as supporting ocean conservation and climate action, for a total of USD 1.24 billion. Almost half aimed to enhance coastal population adaptation for total of USD 590.1 million, for an average amount of funding for ocean conservation and climate action per project of USD 54.1 million. See Table 1 for more detail.

With respect to geographical distribution of these projects (n=158) in aggregate, 30 percent targeted states in Africa, 21 percent each to the Asia and the Pacific regions, 15 percent to the Caribbean, and the remaining 13 percent to South America or other regions. Regarding the distribution of the funding (total = USD 2.23 billion, 52 percent of the funding went to Asia, 22 percent to Africa, 16 percent to the Pacific region, and 5 percent to other regions. Regarding support to SIDS for ocean conservation, 56 projects (35 percent of total) targeted SIDS, for a total funding of USD 482.7 million. Also, 57 percent of funding aimed to help coastal populations adapt to climate-related impacts.

8.2 Innovative Sources of Ocean Financing

Since the last ROCA Progress Report in 2018 the concept of innovative financing for the Blue Economy, and in particular the linkage between ocean and climate finance solutions as well as biodiversity,[294] has evolved further.[295] The need for a comprehensive ocean finance approach[296] and the idea of developing and scaling innovative financing is gaining traction, is receiving support from a number of sources, including the World

294 OECD (2019), Biodiversity: Finance and the Economic and Business Case for Action. https://www.oecd.org/environment/resources/biodiversity/biodiversity-finance-and-the-economic-and-business-case-for-action.htm

295 Wabnitz, C. C. C. and Blasiak, R. (2019). The rapidly changing world of ocean finance. Marine Policy. p 103526

296 Laffoley et al (2019) Eight urgent, fundamental and simultaneous steps needed to restore ocean
health, and the consequences for humanity and the planet of inaction or delay Aquatic Conservation Marine and Freshwater Ecosystems · July DOI: 10.1002/aqc.3182

Table 1. Estimated GCF, GEF and World Bank Aid to Ocean Conservation and Climate Action [2013-2017]

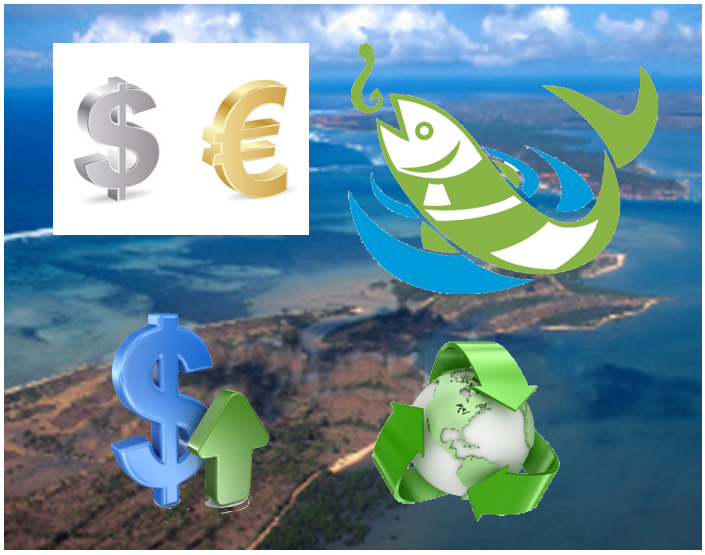
Type of Intervention*	# of Projects Supporting the Type of Intervention	Total Financing (USD m)	Relevant Targets
Ocean pollution reduction measures	6	20.5	SDG 14.1
Coastal and ocean ecosystem management and protection measures			
a) Coastal and ocean protected area measures	a) 33	a) 85.5	a) SDG 14.5
b) Measures to help ocean ecosystems adapt	b) 10	b) 109.7	b) SDG 14.3; 13.1
c) Measures to enhance coastal GHG sinks	c) 3	c) 5.3	c) SDG 14.2
d) All other ecosystem management	d) 71	d) 562.2	d) SDG 14.2
Ocean fisheries management measures	33	423.6	SDG 14.4; 14.7
Measures to help coastal populations adapt to climate-related impacts	64	1342.4	SDG 13.1
Measures to reduce ocean-linked anthropogenic sources of greenhouse gases	0	0	
Measures to increase ocean-based sources of renewable energy	0	0	SDG 7.2
TOTAL	219.0	2,549.2	

Bank ProBlue program[297] and a number of specific examples of innovative ocean finance were implemented in 2019.

January 2019 saw the first larger blue bond launch in the form of the Nordic Investment Bank' Baltic blue bond, delivering funding for water treatment plants and similar measures. A number of initiatives emerged that have helped to further develop relevant frameworks and approaches for blue bonds, including in the spring of 2019 the convening under the Climate Bonds initiative of a Shipping Technical Working Group and Industry Working Group to discuss and develop the Shipping Criteria,[298] the publication of "Blue Bonds: Financing Resilience of Coastal Ecosystems: Key Points for Enhancing Finance Action: A technical guideline prepared for IUCN GMPP,[299] and the launch of the "Blue Bonds for Conservation Initiative" by the Nature Conservancy.[300] The Pacific Ocean Finance Initiative is targeting specific opportunities win this region most effected by climate change, including through a potential Pacific Ocean Bond.

The G7 under the Canadian Presidency in the Charlevoix Blueprint for Healthy Oceans, Seas and Resilient Coastal Communities supported innovative financing for coastal resilience. It stressed the need to mobilize greater support for increasing financial resources, particularly to build coastal resilience in developing countries, and explore new and innovative financing with national and international public and private sector partners. This was followed by the commitment at the Biarritz summit in 2019 to support the Ocean Risk and Resilience Action Alliance,[301] an effort to bring private sector insurance and finance partners to help structure risk mitigation solutions.

Sustainability bonds such as the European Investment Bank Sustainability Awareness Bond of EUR 500 million in 2018, with proceeds allocated to water investment present funding intended to directly support sustainable finance. Resilience bonds emerged in 2019, with The European Bank for Reconstruction and Development (EBRD) issuing September 2019 what the first bond issued to exclusively finance climate resiliency projects. It raised USD 700 million for a yield of 1.737 to 9.2 percent basis points over the five-year Treasury. Proceeds from the bond will be used to finance climate-resilient infrastructure, business and commercial operations, or agricultural and ecological systems. It applied for the first time the Climate Bond Resilience Standards developed by the Climate Bonds Initiative,[302] a new format that will



facilitate projects in that sector, including, importantly, those that benefit coastal communities and ocean health. The Sustainable Blue Economy Finance Principles[303] are increasingly adopted by impact investors and other financiers to guide their ocean finance approaches.

The acknowledgement of the immense impact of climate change on the ocean[304] but also of the potential of the ocean to directly contribute to climate solutions[305] including through the emerging marine renewables sector[306] means that tailored public-private ocean infrastructure and project finance solutions are urgently required. Multilateral development banks are increasingly focusing on this opportunity through dedicated ocean efforts such as the Asian Development Bank's Action Plan for Healthy Oceans and Sustainable Blue Economies' for Asia and the Pacific alongside an ADB Oceans Financing Initiative.[307] The Oceans Financing Initiative aims to create opportunities for the private sector to invest in projects that improve the ocean's health and stimulate the Blue Economy.

Further opportunities for innovative ocean Public-private Partnership (PPP) funding arise from progress in ocean observation,[308] and remote sensing and data technologies. As the sustainable Blue Economy[309] develops, it has to be supported through integrated PPP solutions such as the new BlueInvest[310] approach of

297 http://documents.worldbank.org/curated/en/559541570047740595/pdf/PROBLUE-2019-Annual-Report.pdf
298 https://www.climatebonds.net/shipping
299 https://www.4climate.com/dev/wp-content/uploads/2019/04/Blue-Bonds_final.pdf
300 https://chinadialogueocean.net/7672-nature-conservancy-unveils-us1-6-billion-scheme-to-save-the-oceans/
301 https://www.oceanriskalliance.org
302 https://www.climatebonds.net/climate-resilience-principles
303 Declaration of the sustainable blue economy finance principles: https://ec.europa.eu/maritimeaffairs/sites/maritimeaffairs/files/declaration-sustainable-blue-economy-finance- principles_en.pdf
304 IPCC, 2019: Summary for Policymakers. In: *IPCC Special Report on the Ocean and Cryosphere in a Changing Climate* [H.- O. Pörtner, D.C. Roberts, V. Masson-Delmotte, P. Zhai, M. Tignor, E. Poloczanska, K. Mintenbeck, M. Nicolai, A. Okem, J. Petzold, B. Rama, N. Weyer (eds.)]. In press.
305 Hoegh-Guldberg< O. and E. Northrop (2019) The Ocean as a Solution to Climate Change:
Five Opportunities for Action. High Level Ocean Panel Report
306 World Bank Group, ESMAP and SERIS. 2019. Where Sun Meets Water: Floating Solar Market Report. Washington, DC: World Bank.
307 https://sdg.iisd.org/news/adb-launches-usd-5-billion-action-plan-for-healthy-oceans-sustainable-blue-economies/
308 Rayner, R., Jolly, C., and Gouldman, C. 2019. Ocean Observing and the Blue Economy. Frontiers in Marine Science. doi: 10.3389/fmars.2019.00330
309 European Commission (2019). The EU Blue Economy Report. 2019. Publications Office of the European Union. Luxembourg
310 https://webgate.ec.europa.eu/maritimeforum/en/node/4421

the European Union. The recent Caribbean Oceans and Aquaculture Sustainability Facility[311] is an example of how innovative finance can help fisheries measures for sustainability. As aquaculture matures and sustainability standards are confirmed and adhered to, this important food production sector is attracting new financing from the private sector.[312]

The challenge of ocean plastic,[313] an issue that has significant public interest, has begun to attract innovative financial support, both from public sources and from private investors such as Circulate Capital.[314]

Traditional conservation efforts through MPAs and reef management are increasingly being considered for innovative finance options, given the urgency to address the challenges facing coral reefs[315] and the need to scale MPAs to reach the Aichi Targets of 10 percent by 2020 and the 30 percent fully protected ambition by 2030.

The Blue carbon[316] finance sector is still facing a number of challenges as it develops from a niche opportunity offering social and environmental benefits relevant to CSR towards a mainstream activity.[317] However, it is delivering first examples of transactions, and is expected to grow rapidly once the Paris rulebook is fully in place.

Innovative concepts such as the Blue natural Capital Financing Facility[318] help to deliver bankable transactions and anchor blue carbon deals with additional revenue sources. Innovative finance concepts for resilient coasts offer a way forward[319] and can help to close the funding gap for blue infrastructure and nature-based solutions.

Led by the example of Norges Bank for the Norwegian Sovereign Wealth Fund who issued an "ocean expectations" document in 2018,[320] asset managers are increasingly challenging their investee companies to confirm their sustainability intentions, which should in time focus investment flows into sustainable green and blue deals. As the risks of stranded assets are increasingly recognized both by investors and by financial regulators, these can be assessed and quantified. Efforts such as Fish Tracker Initiative[321] investigate the impact that financial institutions have in financing global wild-catch fisheries and seafood trade and help to align capital markets with sustainable fisheries management.

Other avenues of innovation are rising around concepts such as crowdfunding[322] and blue fintech for conservation,[323] thus ocean finance innovation is well aligned with broader trends in financial innovation. The large infrastructure finance needs in the coastal space in particular require rapid scaling of innovative finance with significant private sector engagement if the ocean-climate nexus is to be appropriately addressed.[324]

311 CCRIF SPC (2019) The Caribbean Oceans and Aquaculture Sustainability Facility: Making the fisheries sector in the Caribbean resilient to climate events. CCRIF SPC. https://www.ccrif.org/sites/default/files/publications/CCRIFSPC_COAST_Brochure_July2019.pdf

312 O'Shea, T., Jones, R., Markham, A., Norell, E., Scott, J., Theuerkauf, S., and T. Waters. 2019. Towards a Blue Revolution: Catalyzing Private Investment in Sustainable Aquaculture Production Systems. The Nature Conservancy and Encourage Capital, Arlington, Virginia, USA

313 Beaumont, N. J., Aanesen, M., Austen, M. C., Börger, T., Clark, J. R., Cole, M., … Wyles, K. J. (2019). Global ecological, social and economic impacts of marine plastic. Marine Pollution Bulletin, 142, 189–195.doi:10.1016/j.marpolbul.2019.03.022

314 https://www.circulatecapital.com

315 Iyer, V., Mathias, K., Meyers, D., Victurine, R., Walsh, M. (2018) Finance tools for coral reef conservation: a guide. Wildlife Conservation Society and Conservation Finance Alliance for 50 Reefs Initiative. Washington, DC.

316 Serrano, O., Kelleway, J. J., Lovelock, C., & Lavery, P. S. (2019). Conservation of Blue Carbon Ecosystems for Climate Change Mitigation and Adaptation. Coastal Wetlands, 965–996. doi:10.1016/b978-0-444-63893-9.00028-9

317 Vanderklift, M. A., Marcos-Martinez, R., Butler, J. R. A., Coleman, M., Lawrence, A., Prislan, H., … Thomas, S. (2019). Constraints and opportunities for market-based finance for the restoration and protection of blue carbon ecosystems. Marine Policy. doi:10.1016/j.marpol.2019.02.001

318 www.bluenaturalcapital.org

319 Deutz, A., Kellett, J., Zoltani, T. 2018. Innovative Finance For Resilient Coasts And Communities. A briefing paper prepared by The Nature Conservancy and the United Nations Development Programme for Environment and Climate Change Canada.

320 NBIM (2018) Ocean sustainability: expectations towards companies. Norges Bank Investment Management. https://www.nbim.no/contentassets/7a4dda85e6094f7b84cc3a3a10be628f/nbim_expectations_oceans.pdf [Accessed 29/08/2019]

321 https://planet-tracker.org/tracker-programmes/soft-commodities/seafood/

322 Martinez-Clement, C., Costa-Climent, R. and Oghazi, P. (2019) Sustainable financing through crowdfunding. MDPI. Sustainability 11, 934. Doi:10.3390/su11030934

323 https://us.acrofan.com/detail.php?number=152180

324 https://www.businesslive.co.za/bd/opinion/2019-09-23-listen-to-the-oceans-call-we-need-to-keep-them-resilient/

9. CAPACITY DEVELOPMENT

Roadmap Recommendation: Provide technical and financial assistance to SIDS, developing countries, and economies in transition to build capacity in the form of knowledge, tools, and scientific and political expertise to empower people to implement mitigation and adaptation measures, develop adaptive management capacity, early warning systems, and disaster risk reduction, and develop knowledge management mechanisms to share knowledge among all countries within and outside the UNFCCC frameworks.

9.1 Building Capacity for Oceans in a Changing Climate: Update 2019

In 2001, the UNFCCC adopted a capacity-building framework for developing countries. This decision, almost 20 years ago, recognized capacity-building as a critical pre-requisite for developing country Parties to be able to fully meet their Convention obligations. Since 2001, many programs within and outside the UNFCCC to enrich capacity-building programs for climate change have been funded and operated.

Despite some clear victories in advancing capacity for climate change, there remain many key shortfalls. For SDGs, for climate change, and for oceans, there are still large gaps in available capacity-building programs for community members and professionals in government, civil society, academia, and the private sector. Often, capacity-building initiatives are discrete programs that lack strong institutional anchoring, coordination, and country-ownership.

Recognizing the ongoing need to enhance and improve capacity-building and education, Articles 11 (Capacity-Building) and 12 (Education) were included as key elements of the Paris Agreement. Also at COP21, the Paris Committee on Capacity-building (PCCB) was established to address gaps and needs in capacity-building and to enhance capacity-building and coordination through a 2016-2020 workplan.

2019 Updates

Capacity-building continues to be an important topic in 2019, both within the UNFCCC and outside. Several observations can be made about the pace and quality of actions and initiatives in 2019 related to capacity-building and oceans:

- Capacity-building continues to be seen as a key enabler of deeper climate action across all SDG and climate change topics;

- An enormous gap remains between capacity-building needs and capacity-building resources. This gap directly impedes action on ocean and climate mitigation and adaptation;
- There is a growing emphasis on coordination of efforts for capacity-building;
- As the topic of oceans continues to rise in importance within the UNFCCC, there are excellent opportunities to amplify the importance of capacity-building within the Convention. This includes for Parties and observers to use a potential new workplan for the PCCB to directly integrate oceans topics into its next work plan.
- It is important to learn from past successes and failures related to capacity-building to improve the long-term, country-owned capacity-building institutions and efforts;
- A concerted effort to support academic institutions to directly enable deeper climate change ambition for both mitigation and adaptation is needed.

2019 UNFCCC Capacity-building Developments

In 2019, the Paris Committee on Capacity-building, the Durban Forum on Capacity-building continued it's work, as well as important capacity-building work by many other bodies (Climate Technology Centre & Network, Clean Development Mechanism (CDM) Executive Board, etc.). While these UNFCCC capacity-building efforts are underway, many are tangential to oceans and coastal communities. This is due to the relatively low formal integration of oceans into the UNFCCC thus far (and this may change) as well as the abundant need for capacity building in all other area of climate change action. While some of these systems are starting to address needs for new forms of education and training for ocean and climate issues, a key challenge in coming years is to embed and enhance ocean needs into climate change

capacity-building coordination efforts.

In 2019, several key UNFCCC developments have taken place related to capacity-building with varying relevance to oceans and coastal communities:

SBI Capacity-building Synthesis Report Issued[325]

A third SBI report, "Implementation of the framework for capacity-building in developing countries: A Synthesis" on capacity-building within the Convention includes an overall synthesis of capacity-building through the UNFCCC process. It contained several references to ocean and climate change (in addition to serving as a compendium of ongoing programs and emerging topics).

"Parties highlighted the need for: "Strengthening the capacity of researchers through training; engaging with universities and research centres, centres of excellence and research networks; accessing information; and postgraduate programmes on climate change…including an integrated environmental monitoring network or an oceanographic data programme."[326] In addition, the report noted clear gaps in capacity progress related to a range of coastal issues, from erosion control to monitoring, mangroves and coastal monitoring. Five Parties reported "coasts" as key sectors for capacity-building, ranking it the 11th most important sector as reported by Parties. This suggests that coastal and ocean issues are starting to be specifically requested as areas of importance for Parties to the UNFCCC.

2019 PCCB Reports

Also, a "Technical Paper on coherence and coordination of capacity-building activities of constituted bodies and in other relevant processes under the Convention" was released in 2019.[327] The report concluded more was needed in terms of communicating work across bodies within the UNFCCC on climate change capacity building. Although there was no mention of ocean or coastal issues in the report, a workshop was proposed to help coordinate work and this could be one area where the ocean community could increase its profile.

It is important to note that the PCCB is not an implementer or funder of capacity-building. Rather, the PCCB's work aims to strengthen coordination, communications and stakeholder engagement in on-going efforts. Some of the coordination that needs to occur is between the Consultative Group of Experts (CGE), the CTCN, the CDM Executive Board, the Least Developed Countries Expert Group (LEG), Capacity-building Initiative for Transparency (CBIT), the Nairobi Framework Partnership as well as coordination with GEFand IPCC.[328]

In 2019, the PCCB also produced the "Paris Committee on Capacity-building Strategic Plan for Stakeholder Engagement, Communications and Resource Mobilization."[329] Among other things, this report calls for a new "PCCB Network," to increase coordination and to ensure efforts are more systematic and targeted. This report also contained no explicit mention of ocean or coastal issues. But if such a network moves forward, it is another opportunity for the ocean community to integrate its work on capacity building with that of PCCB and to a larger extent, with the UNFCCC.

8th Durban Forum in Capacity-building[330]

The 8th Durban Forum on Capacity-building was held at SB 49. It hosted an excellent panel discussion to address, discuss and make recommendations on four key topics:

(a) How better to engage academia, research institutions and other non-Party stakeholders in strengthening and retaining capacities?

(b) Challenges and opportunities for enhancing coherence and coordination in the design and implementation of capacity-building activities?

(c) What needs to be done to better monitor and assess the impact of capacity- building activities?

(d) What type of support is needed for strengthening national institutions to support capacity-building activities?

The above report is an excellent resource of key lessons learned and suggestions for capacity-building. While it did not address oceans or coasts directly, as oceans and coastal issues become more important to the UNFCCC, lessons learned should be integrated into future ocean-related capacity-building.

All of the above reports provide windows to better raise ocean issues into capacity-building efforts. None of these UNFCCC reports have a strong focus on oceans and climate change (in fact several do not even mention the topics), they represent key opportunities to better include ocean capacity building issues within the UNFCCC process.

Capacity-building Hub 2019

Also in 2019, it was decided that a Capacity-building Hub[331] will be carried out at COP25. Again, this hub provides the ocean community with opportunities to

325 UNFCCC/SBI/2019/3 https://unfccc.int/sites/default/files/resource/03.pdf
326 UNFCCC/SBI/2019/3, para 43.
327 https://unfccc.int/sites/default/files/resource/20190925_PCCB_TP_COHERENCECOORDINATION.pdf
328 Paris Committee on Capacity-building. Coherence and coordination of capacity-building activities of constituted bodies and in other relevant processes under the Convention. Technical Paper, September 2019.
329 PCCB Strategic Plan for Stakeholder Engagement, Communications and Resource Mobilization. UNFCCC Paris Committee on Capacity-building (PCCB). Bonn, July 2019. https://unfccc.int/sites/default/files/resource/20190715-Strategic%20plan%20FINAL%20Version_0.pdf
330 FCCC/SBI/2019/11 https://unfccc.int/documents/198789
331 https://unfccc.int/2nd-capacity-building-hub

elevate capacity-building for oceans and coastal issues within the UNFCCC process.

Developments on Capacity-building Outside the UNFCCC

The IPCC Special Report on Ocean and Cryosphere in a Changing Climate[332] recognizes the following challenges related to capacity development in planning for and responding to climate change in oceans and coastal zones:

1. Impacts of climate change in the ocean and cryosphere increasingly challenge governance efforts to develop and implement adaptation responses at various scales and that people with the highest exposure and vulnerability are often those with lowest capacity to respond.
2. Strengthening response options involves supporting ocean and cryosphere ecosystem services by protection, restoration, precautionary ecosystem-based management of renewable resource use, and the reduction of pollution and other stressors. Confronted with ecological, financial, institutional and governance barriers to such actions, coastal communities face challenging choices in crafting context-specific and integrated responses to sea level rise that are economically viable and adaptable over time.
3. Enabling climate resilience and sustainable development depends critically on urgent and ambitious emissions reductions along with coordinated sustained and increasingly ambitious adaptation actions. Intensifying cooperation and coordination among governing authorities across spatial scales and planning horizons; education and climate literacy; monitoring and forecasting; use of all available knowledge sources; sharing of data, information and knowledge; finance; addressing social vulnerability and equity; and institutional support are investments that enable capacity building, social learning, and participation that are essential for implementing effective responses to climate-related changes in the ocean and cryosphere.

Specific activities include, among others: 1) use of multiple knowledge systems and regional climate information in decision making, and the engagement of local communities, Indigenous peoples, and relevant stakeholders in adaptive governance arrangements and planning frameworks; 2) promotion of climate literacy and public awareness, understanding and social learning about locality-specific risk and response potential.

332 IPCC (2019) Summary for Policymakers. In: IPCC Special Report on the Ocean and Cryosphere in a Changing Climate [H.O. Pörtner, D.C. Roberts, V. Masson-Delmotte, P. Zhai, M. Tignor, E. Poloczanska, K. Mintenbeck, M. Nicolai, A. Okem, J. Petzold, B. Rama, N. Weyer (eds.)]. In press. https://www.ipcc.ch/srocc/home/

United Nations Decade of Ocean Science for Sustainable Development (2021-2030)

In 2017, the United Nations (UN) Decade of Ocean Science for Sustainable Development was proclaimed. It is defined as a framework to ensure ocean science has the capacity to support states in their actions towards the sustainable management of the world ocean and the goal to achieve the 2030 Agenda for Sustainable Development. A key area of work during the Decade will be capacity development. It is envisaged that the Decade will improve the scientific knowledge base through capacity development to regions and groups that are presently limited in capacity and capability, especially Small Island Developing States and the Least Developed Countries. These activities first have to be designed and mapped to serve the global scientific objectives as well as local and national needs.

An Executive Planning Group (EPG) was established in November 2018, composed of 19 experts. They support the IOC governing bodies as an advisory body in the preparation of the Decade. The outcomes of their first meeting (Paris, December 2018) were, among others, a Revised Roadmap for the Decade, and a call and related guidelines to organizations and countries to express interests in the preparation and implementation of the Decade.

The Decade was discussed at the Oceans Action Day at COP 24 in December 2018, which highlighted opportunities and needs to be considered in its implementation. These include, among others, to rely on both natural and social sciences, and multi-stakeholder dialogues to ensure that gender, youth and indigenous peoples are engaged in conversations and actions related to ocean science for sustainable development. The discussion also addressed how the Decade, and in particular its capacity development activities, can help achieve the Paris Agreement and vice versa.

A first Global Planning Meeting held in Copenhagen in May 2019 resulted in the identification of scientific knowledge gaps to achieve the six societal goals of the Decade (a clean, healthy and resilient, predicted, safe, sustainably harvested and productive, "transparent and accessible" ocean). These societal goals are relevant to the UN at large and the UNFCCC in particular. At its 48th session, the Subsidiary Body for Scientific and Technological Advice (SBSTA) of the UNFCCC "encouraged Parties and relevant organizations to address gaps and needs with regard to the role of the ocean in the global climate system, noting the proclamation by the United Nations of the United Nations Decade of Ocean Science for Sustainable Development (2021–2030)". The fourth main theme of the 11th Research Dialogue of the SBSTA50, which took place in June 2019, was "the role of the oceans in the climate system", under

which impacts of multiple ocean stressors, and benefits of ecosystem-based management as well as blue carbon ecosystems, were addressed. The UNFCCC Secretariat also joined the UN Decade of Ocean Science via its participation in UN-Oceans.

In 2020, after a review by the 52nd session of the IOC Executive Council, the Implementation Plan of the Decade, which will also include a Science Action Plan as well as actions and activities on ocean science capacity development, will be submitted to the 75th session of the UN General Assembly. The opportunities to contribute to populating the Decade's Implementation Plan until then are multiple, especially through the planned regional consultations for the South and North Atlantic, Indian Ocean and the Mediterranean Sea (scheduled between November 2019 and January 2020) and the 2nd planning global meeting to be held in March 2020 in Paris.

UN Secretary General's Climate Action Summit, 23 September 2019, New York[333,334]

To increase ambition and accelerate action to implement the Paris Agreement, the Climate Action Summit focused on nine interdependent tracks, among which is Nature-based Solutions. The tracks were led by 19 countries and supported by international organizations

Nature-based Solutions focuses on forests and land-based ecosystems, smart agriculture and food systems, regeneration of life in rivers, lakes and oceans, and enabling connections among all people and nature. It is led by China and New Zealand and supported by the United Nations Environment Programme (UNEP) and Mr. David Nabarro, Strategic Director of Skills, Systems and Synergies for Sustainable Development.

Actions on terrestrial and ocean ecosystems as well as fresh water and sustainable food systems are essential for reaching the goals of the Paris Agreement and achieving carbon net zero by 2050. Actions can take many forms, e.g., enhancing NBS-focused capacity-building, research and technology; developing knowledge and research tools for NBS.

Conclusions

There have been many investments in education and science and competencies related to the oceans and climate change and SDGs outside the convention process. There are many excellent ocean and climate professionals and institutions in developing countries and these should continue to be supported. Further, these should be supported to further incorporate climate change issues with an aim of helping communities and countries meet the Paris Agreement objectives.

In terms of climate change and the ocean and coastal communities, capacity-building efforts supported by the Convention are still in their infancy. If the global community hopes to stabilize at 1.5 C, efforts on oceans and climate change in terms of capacity-building must be systematically strengthened and be focused on embedding new capacity-building into national and regional institutions and enhancing pre-existing academic programs to better address climate and oceans educational gaps.

9.2 Capacity Development in the European Union

Climate change adaptation and mitigation are mainstreamed in EU international cooperation and development policy. A number of programmes/projects aim at i) measuring the impact of climate change on oceans and coastal areas, ii) developing adaptation strategies and/ or iii) promoting mitigation measures.

The Global Climate Change Alliance Plus (GCCA+)[335] was established in 2007 and provides a platform for dialogue and cooperation and technical and financial support to the Least Developed Countries and Small Island Developing States in the areas of climate change adaptation and mitigation as well as disaster risk reduction. The GCCA+ is today supporting over 70 projects of national, regional and worldwide scope in Africa, Asia, the Caribeean and the Pacific, focusing on building climate resilience in LDCs and SIDS but also expanded since 2015 to include middle-income countries and the new lens of Nationally Determined Contributions (NDCs). It represents about EUR 750 million for the period 2008-2020. CGGA+ is active in various sectors including coastal management with the set-up of marine protected areas as well as fisheries and aquaculture. This is the case, for example, in Jamaica, Comoros, Cuba, Gambia, Mauritius, Mozambique, Seychelles, Suriname. The EU also participates in the Joint Pacific Initiative on Biodiversity, Climate Change and Resilience[336] launched by France to increase the capacities of 19 Pacific states and territories to adapt to the impact of climate change and other stressors and to protect, restore, and enhance biodiversity in order to strengthen the resilience of their socio-ecological systems.

The EU is also promoting offshore energy across the world, for instance by mobilising technical expertise to help India launch the tender of its first offshore wind farm this year and to support the development of a new offshore wind energy market, aligned with best environmental, societal and technical practices. The EU has earmarked EUR 2.3 million for this purpose.

333 United Nations (2019) Raising ambition. https://www.un.org/en/climatechange/climate-action-areas.shtml

334 United Nations (2019) Secretary-General's Climate Action Summit. Track #6: Nature-Based Solutions. Workplan. https://www.un.org/sustainabledevelopment/workplan/nature-based-solutions.pdf

335 http://www.gcca.eu/

336 https://ec.europa.eu/europeaid/news-and-events/eu-france-and-new-zealand-launch-pacific-initiative-biodiversity-climate-change-and_en

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