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Assessing Progress on Ocean and Climate Action: 2018

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

Authors: Biliana Cicin-Sain, Alexis Maxwell, Miriam Balgos, Meredith Kurz, Brian Cortes, Vanessa C.S. Knecht, Global Ocean Forum and University of Delaware; Carol Turley, Plymouth Marine Laboratory; Tarub Bahri, FAO; Dorothee Herr, IUCN; Kirsten Isensee, IOC, UNESCO; Peter Ricketts, Acadia University and Coastal Zone Canada; Atsushi Sunami, Miko Maekawa, Masanori Kobayashi, OPRI, Sasakawa Peace Foundation, Japan; John Virdin, Tibor Vegh, Duke University and ROCA; Torsten Thiele, Ocean Trust

**Authors are participating in their informal capacities*

COP 24 Version for Comment

This report is issued as an interim version for consideration and comment at the UNFCCC COP 24, Katowice Poland, especially at the Oceans Action Day at COP 24

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Comments may be sent to Dr. Biliana Cicin-Sain, Global Ocean Forum, bilianacicin-sain@globaloceans.org

ROCA Leadership

Global Ocean Forum

Initial ROCA Partners

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OVERVIEW

THE OCEANS AND CLIMATE NEXUS AT COP 24: KEY ISSUES

UN Secretary-General Antonio Guterres on the IPCC 1.5°C Report

"This report by the world's leading climate scientists is an ear-splitting wake-up call to the world. It confirms that climate change is running faster than we are, and we are running out of time. […] I urge all countries to make the Katowice Climate Conference a success and heed the counsel of the world's top scientists: raise ambition, rapidly strengthen their national climate action plans, and urgently accelerate implementation of the Paris Agreement," said the UN chief. […] We must rise to the challenge of climate action and do what science demands before it is too late."

Introduction

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 2018. Each section reviews the recommendations from the *Strategic Action Roadmap to Oceans 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 oceans 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.**

Contents

New Scientific Findings

We must frame our discussions on the Oceans and Climate Nexus in the UNFCCC COP 24 in the context of new relevant scientific evidence. We are referring here, in particular, to the IPCC report on 1.5°C. As you 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 to stay alive."

The 1.5° 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 likelihood 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 (CO_2) would need to fall by about 45 percent from 2010**

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.

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."*

The implications of the IPCC Report 1.5° 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."***

Can the requisite rapid movement to decarbonization of our societies be realized in the short time left available? It will be exceedingly difficult, but there is hope. As noted by Rachel Kyte, CEO for Sustainable Energy for All and Special Representative of the UN Secretary-General, *"This report is devastating in detailing the size of the challenge before us to manage our economies to stay well below 2 degrees of warming. But we can do it. What's important now is how we react to this report. We have known for some time the price of inaction is far higher than action. That price just got even higher……Many of the solutions we need are at hand. We have to use carbon and manage each molecule so it doesn't escape into the atmosphere. We have to be driving forward hard the renewable energy revolution. The beauty of this revolution is that we can also make energy services inclusive – leaving no one behind…..*

The US Climate Change report, released earlier this month, evokes a number of the points raised in the IPCC 1.5°C report regarding global developments at a national level in the United States. The conclusions in the Fourth U.S. National Climate Assessment (NCA4), released in November 2018 by the U.S. Global Change Research Program (USGCRP), underlined that negative impacts of climate change are not a hypothetical future scenario but are already causing damages to U.S. lives and livelihoods.[2] The NCA4 stated that many coastal regions in the country would be utterly transformed by the end of the century, through a combination of ocean warming, sea level rise, ocean acidification, coastal erosion, more intense storm surge, and an increased number of heavy precipitation events. In particular, coral reef and Arctic ecosystems are already experiencing significant impacts, which has already been detrimental to the economies which depend on their health. The findings on a national level are in line with IPCC findings on a global scale.

As we focus our efforts on much accelerated upgrading of mitigation ambition, "we must devote as much energy in securing our priorities on adaptation and loss and damage as we do on mitigation ambition"[3] --the extensive and severe impacts of climate change can already be seen and felt in countries and communities around the world.

Approaching the Oceans and Climate Nexus in an Integrated Fashion

The nexus between climate and oceans and coastal zones, currently one of the seven thematic areas in the UNFCCC Global Climate Action Program, has been featuring in the UNFCCC process through Oceans Action Days and other means since the 2009 COP 15, calling attention to the central role of oceans in the climate system and the need to address a wide range of impacts arising from climate change on the oceans and on peoples in 183 coastal and island nations. Several international multistakeholder coalitions/initiatives have been working to advance these issues in the context of the UNFCCC, including, inter alia, the Roadmap to Oceans and Climate Action (ROCA), the Because the Ocean Initiative, the Ocean and Climate Platform.[4] The approach embodied in the Roadmap to Oceans and Climate Action is an integrated one, holding that ocean and climate issues 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

2 https://nca2018.globalchange.gov/

3 As noted by Thoriq Ibrahim, Chair, Alliance of Small Island States, Islands Need Support to Face Shocking Impacts of 1.5° Global Warming, November 11, 2018.

4 See the following links for the various climate and ocean initiatives:

ROCA

Roadmap to Oceans and Climate Action Initiative (ROCA) Information Leaflet, http://bit.ly/2HgYhjK

Toward a Strategic Action Roadmap on Oceans and Climate: 2016 to 2021, http://bit.ly/2hzqvyV

Assessing Progress on Oceans and Climate Action: 2016-2017 Report, http://bit.ly/2h94kw3

Oceans Action Day at COP 23 Summary, http://bit.ly/2HSsvuA; Oceans Action Day Bulletin and IISD Reporting Services Conference Coverage, http://bit.ly/2yRGw6U

Ocean and Climate Platform

Website: https://ocean-climate.org/?lang=en

Measuring Progress on Ocean and Climate Initiatives: An Action-Oriented Report, http://bit.ly/2hyT6RD

Because the Ocean Initiative

https://minrel.gob.cl/foreign-minister-munoz-signed-second-because-the-ocean-declaration-and/minrel/2017-05-19/151930.html

http://www.iddri.org/Themes/Oceans-et-zones-cotieres/Because-the-Ocean-Declaration-sur-le-Climat-et-les-Oceans

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. All of these elements are intertwined and must be addressed as a whole.

Progress Report on Oceans and Climate Action 2018: Bad News, Good News

In the following sections, this Progress Report for 2018 addresses progress (or lack thereof) in the following categories: 2. The central role of oceans in climate and associate science and policy issues; 3. The central role of Nationally Determined Contributions; 4. Mitigation; 5. Adaptation; 6. Blue Economy; 7. Population Displacement; 8. Financing on Oceans and Climate; 9. Capacity Development; and 10. Oceans at COP 24, Katowice, Poland.

The report on the oceans and climate nexus in 2018 is sobering, alarming, and yet there are positive signs of success in efforts to address the oceans and climate issues, as highlighted below.

Central Role of Oceans in Climate

Scientific Findings

- Sea surface temperatures in 2017 were the third warmest on record, following 2015 and 2016
- Increased ocean heat content is predicted to intensify tropical storms and both 2017 and 2018 were exceptional years of tropical storms
- If current rates of emissions continue, most tropical coral reefs ecosystems are unlikely to survive the increase in sea surface temperature in the same form, with greatly diminished goods and services
- In 2018, researchers found that the AMOC (the ocean circulation which regulates climate in countries with an Atlantic coast) is the weakest that it has ever been in the last 1,600 years
- In October 2018, Arctic sea ice extent was the third lowest on record
- At the current rate of CO2 emissions, the mean surface pH is predicted to decrease by another 0.3 to 0.4 units, the equivalent to a 100-150% increase in acidity, with significant impacts on marine resources and peoples using these resources

Climate change on fisheries

- Climate change under a high emissions scenario is projected to reduce fish catch globally by 6% and by 30% in tropical regions by 2050 where, due to their dependency on wild fish and their poor current adaptive capacity, the most vulnerable communities live
- Declining fish catch indicates that the nutrition of about 1.4 billion people is at risk because fish make up over 20% of their animal-based food

Key new scientific reports

- To achieve a medium chance of limiting warming to 1.5°C, the world can only emit 770 additional gigatonnes of carbon dioxide. If all countries meet their Paris Agreement goals, that "carbon budget" will be spent by 2030 (IPCC report)
- The risks of declining ocean productivity, shifts of species to higher latitudes, damage to ecosystems (e.g. coral reefs, and mangroves, seagrass and other wetland ecosystems), loss of fisheries productivity (at low latitudes), and changing ocean chemistry (e.g., acidification, hypoxia, dead zones), however there are projected to be substantially lower when global warming is limited to 1.5°C (IPCC report)
- Many coastal regions in the country (US) would be utterly transformed by the end of the century, through a combination of ocean warming, sea level rise, ocean acidification, coastal erosion, more intense storm surge, and an increased number of heavy precipitation events (Fourth US National Climate Assessment)

Updates on Paris Agreement, UN processes, and other international efforts

- Since the 2016-2017 ROCA Progress Report, an additional 17 Parties have ratified the Paris Agreement bringing the total to 179 Parties out of 195 Party signatories
- The introduction of the Ocean Pathway Initiative by the Fiji Presidency at COP 23, designed to put ocean and climate issues squarely within the official deliberations of the UNFCCC, was a significant accomplishment
- Nearly 50 commitments on the "climate change" theme were created or renewed at the Bali Our Oceans Conference

NDCs

- 70% of NDCs address ocean and coastal issues
- The Talanoa Dialogue began in January 2018 with the submission of Party and non-Party stakeholder inputs, which are defined by three overarching questions: 1) "Where are we?" 2) "Where do we want to go?" and 3) "How do we get there?" Several submissions to the Talanoa Dialogue on the oceans

and climate nexus were made

-- Several workshops on the incorporation of the ocean in NDCs have been organized under the aegis of the Because the Ocean initiative, and more are scheduled to take place in 2019

Mitigation

-- Blue Carbon

-- The MRP Map (Mangrove Restoration Potential) shows that restoration of lost mangroves worldwide could lead to the storage of an extra 69 million tonnes (0.069 gigatonnes) of carbon in aboveground biomass and would also help to avoid further emissions of some 0.296 gigatonnes of soil carbon. Such numbers convert to the equivalent of annual emissions from 25 million US homes in sequestration and 117 million homes in avoided emissions

-- In terms of financing, new initiatives like the Blue Natural Capital Financing Facility (BNCFF) have emerged to help create a pipeline of bankable investment opportunities for coastal resilience projects with clear ecosystem service benefits, including blue carbon

-- Shipping Emissions

-- The IMO has committed to reducing annual GHG emissions by 50% by 2050, compared to 2008 levels, as well as to reaching peak emissions as soon as possible. Projections suggest that with no action, 2050 shipping emissions could increase by up to 300% from 2008 levels under high demand scenarios. The IMO plans to utilize technological and operational improvements to mitigate emissions growth caused by increased demand for shipping, as well as low and zero carbon fuel sources

-- Offshore Renewables

-- The Renewable Energy Agency (IRENA) has continued its efforts specifically geared towards building energy independence across Small Island Developing States, surpassing its ambitious goal of developing 100 MW of solar PV and 20 MW of wind power and raising USD 500 million

-- The Walney Extension Offshore Wind Farm opened in September 2018, becoming the world's largest operational wind farm at a total capacity of 659 megawatts. The project will ideally be able to power roughly 600,000 homes in the United Kingdom

-- Carbon capture and storage

-- A scientific analysis by Gattuso et al. examined a wide range of large-scale measures that are likely to be effective at moderating warming and/or acidification, but require a great deal more research before their technological feasibility, cost effectiveness, and potential negative side effects can be assessed. The study underscored the importance of an ambitious renewable energy transition as the only method the global community knows will be highly effective and can feasibly implement in the required short time scales

Adaptation

-- 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..... Governments at all levels must develop clear policies for coastal protection, planning and damage response.....to manage the world's coastlines as climate change continues to increase exposure to hazard and risk

-- The year 2017 was one of the most devastating yet for highlighting the enormous effects that climate change is having on the world's coasts and the subsequent impacts upon the global population.....

causing loss of life and livelihood as well as inflicting billions of dollars of damage to buildings, harbours, and other infrastructure

-- Low-lying small island developing states (SIDS) are facing the prospect of complete submergence and in some cases the necessity of evacuating their entire population to another country. It is predicted that for the world's 52 small island states, 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

-- The IPCC report on the implications of a 1.5°C increase in global warming 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 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

-- In some parts of the world, wholesale evacuation of coastal areas is becoming more and more a necessity as the impacts of climate change become more dangerous and uncontrollable

-- The Least Developed Countries Fund (LDCF) and the Special Climate Change Fund (SCCF) have been the engines of a pioneering portfolio of over 330 adaptation projects and programs, with over $1.5 billion in grant resources to date

Blue Economy

-- The June 2018 Our Ocean Conference in Bali, Indonesia, resulted in 48 tangible and measurable commitments specifically regarding the blue economy. The European Union has maintained its 250E million investment into an All-Atlantic Ocean Research Alliance that seeks to support over 1000 Atlantic research teams from the Arctic to the Antarctic by 2020

-- The World Bank has committed more than USD 1 billion to advance the sustainable oceans and Blue Economy agenda in developing countries

Population Displacement

-- 18.8 million people in 135 countries were displaced due to environmental disasters in 2018

-- A certain level of climate-induced displacement is now considered unavoidable, and resilience development through disaster risk reduction is becoming highly relevant for displaced persons

-- 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

-- Climate impacts could displace as many as 140 million people within their own borders by 2050

Financing on Oceans and Climate

-- The ROCA Initiative is preparing a financial report tracking public financing related to ocean-based mitigation, adaptation, capacity building, etc. to coastal countries and SIDS

-- Innovative financing, including accessing capital markets, represents a promising opportunity for delivering ocean solutions, including for critically threatened ecosystems such as coral reefs and for the high seas

-- Corporate climate bonds provide an example of private-sector finance for renewables, future "blue bonds" for ocean solutions and environmental impact and sustainability bonds for instance for coastal resilience and nature-based infrastructure could provide formats that would deliver cash up front and could include performance-based components that would allow risk sharing and faster delivery

-- $13.5 billion in funding for ocean projects in SIDS was included in the voluntary commitments registered at the UN Oceans Conference in 2017. The fifth Our Ocean Conference in Indonesia in October 2018 delivered a broad range of commitments for a number of predetermined areas of action, with 305 measurable commitments and a USD 10.7 billion monetary total

Capacity Development

-- The Paris Committee on Capacity-Building (PCCB) was established with the aim to address gaps and needs, both current and emerging, in implementing capacity-building in developing country Parties and further enhancing capacity-building efforts, including with regard to coherence and coordination in capacity-building activities under the Convention

-- The Global Compact for Safe, Orderly and Regular Migration strives to create conducive conditions that enable all migrants to enrich our societies through their human, economic and social capacities, and thus facilitate their contributions to sustainable development at the local, national, regional, and global levels

Agenda for Policy Action on the Oceans and Climate Nexus at the UFCCC

Oceans and coastal zones received top priority during COP 23 in Bonn when the Fiji Presidency announced the Ocean Pathway, aimed at achieving systematic deliberation of the nexus between oceans and the climate actions under the UNFCCC and the Paris Agreement in 2018 and beyond, both through the addressing of these issues within various UNFCCC bodies and processes and the eventual submission of an agenda item for consideration by the COP to consider the development of a Work Program related to oceans and climate within the UNFCCC.

During 2018, a number of meetings were held to begin to develop a vision and agenda for concrete action related to the oceans and climate nexus for the period 2019-2021. These included, inter alia, The Lisbon Strategic Discussion on Advancing Oceans within the UNFCCC, March 21-22, 2018 in Lisbon, Portugal,[5] meetings of the UNFCCC Friends of the Ocean organized by the Ocean Pathway during the UNFCCC Bonn meetings (April 30 to May 10, 2018), during the Bangkok Climate Change Conference (September 4-9, 2018). In addition, several submissions to the Talanoa Dialogue, and several papers outlining possible strategies for the way forward have been prepared.[6]

These efforts have emphasized the desirability of addressing the ocean and climate nexus within the UNFCCC, especially in terms of two major challenges currently being faced in the UNFCCC process.

The UNFCCC and its Paris Agreement are currently struggling to enhance ambition on climate action both at the global and national scale, in particular via the Nationally Determined Contributions (NDCs) process, since current commitments or contributions have demonstrated to be insufficient to achieve the 2°C degree target --not to say the target of 1.5°C--and to ensure adaptation of ecosystems and populations to climate change. In this regard, Parties and Non- State Parties have been actively working on identifying opportunities to increase ambition at the scale required to achieve the agreed goals.

Among other suggestions to increase ambition to the desired level, there is a need for a broader inclusion of the ocean in global climate action, including in the mitigation and adaptation components of NDCs. This would contribute to address as many sources or sinks of greenhouse gases as possible, including oceans and coastal-marine ecosystems, which play a critical role in the adaptation capacity of the planet.

The Global Stocktaking process, currently in the design phase, will be a main tool to track progress towards the achievement of the Paris Agreement goals. There is not yet clarity on the extent to which natural solutions (such as the overall role of oceans as a major carbon sink) will be considered in that assessment and the measures that can be taken to enhance this role both through global and national climate action. NDCs in general have assumed a terrestrial perspective and less attention has been paid to the coastal-marine activities as well as to the role of oceans.

A Step by Step Approach

In order to enhance opportunities to increase ambition on climate action, there is a need to clearly understand what could be the role of oceans and coastal-marine ecosystems as well as to identify gaps in science and knowledge, policy guidance, methodological approaches, capacity building and other means of implementation to support global and national action.

Based on the need for a party-driven process and considering existing bodies and processes in the UNFCCC, there is a need for a step-by-step and adaptive process that ensures the deployment of an inclusive political dialogue on the contributions of oceans to achievement of the climate global goals. We need to clarify the scope and nature of required climate action, through UNFCCC established mechanisms such as the Subsidiary Bodies under the guidance of the COP.

The following initial steps are suggested.

1. Within the Formal UNFCCC Processes

Consideration of Two IPCC Reports and their Implications for Mitigation and Adaptation Related to Oceans and Coastal and Island Populations

The IPCC 1.5° report

Building on an initiative by the Government of Chile[7] at the SBSTA and SBI meetings in Bonn in May 2018 and on a submission to the Talanoa Dialogue by the

5 Hosted with the financial support of the Oceano Azul Foundation, Portugal, at the Oceanoario de Lisboa, and co-organized by the Oceano Azul Foundation, Global Ocean Forum, IUCN, Conservation International, and ROCA (Roadmap to Oceans and Climate Action)

6 1) Considering Oceans in the Climate Regime: Opportunities and Strategic Considerations, Working paper by Climate Focus commissioned by IUCN, January, 2018

2) A Pathway to Enhance the Contribution of Oceans to Achieve Climate Global Goals, Submission to the 2018 UNFCCC Talanoa Dialogue from GOF et al., April 2, 2018

3) Climate Change and the Ocean: Key Linkages, Needed Actions, and Options for Further Steps

Sue Biniaz and Daniel Bodansky, August, 2018

4) Analysis of the SDM of the 1.5 report from the ocean perspective, Salvatore Aricò, Head of the Ocean Science Section, Intergovernmental Oceanographic, Commission of UNESCO, October, 2018

5) Review of Paris Agreement Work Programme (PAWP) Texts, Daniel Bodansky and Sue Biniaz, October, 2018

6) A Pathway to Enhance the Contribution of Oceans to Achieve Climate Global Goals Submission to the 2018 UNFCCC Talanoa Dialogue from GOF, October 2018.

7 Some possible decision language for Ocean – Climate action in decision 1/CP.24, Julio Cordano, Chief, Climate Change and Sustainable Development, Department, Ministry of Foreign Affairs, Chile, May, 2019

Global Ocean Forum/International Coastal and Ocean Organization and other organizations, we propose the consideration by the UNFCCC Secretariat and the subsidiary bodies (SBSTA/SBI) to pursue the following action at COP 24:

-- Organize an in-session workshop to be held during the 50th session of the [SBSTA] [SBI] (June 2019), open to observers, on opportunities to conserve and enhance the oceans and other coastal and marine ecosystems, both for mitigation and adaptation, with a view to sharing best practices and lessons learned, including in the context of designing, implementing, and updating Nationally Determined Contributions.

-- The in-session workshop should identify gaps in science and policy to enhance the role of oceans in achieving global climate goals both at the national and global levels, including providing further guidance on the inclusion of oceans climate action in the NDCs and in other relevant bodies or initiatives of the UNFCCC, taking into account work by the IPCC on oceans and climate in the context of the relevant special reports, the IPCC Global Warming of 1.5°C report and ongoing IPCC Special Report on The Ocean, Cryosphere and Climate Change

-- Prepare a report on the in-session workshop for consideration at the 51st session of the [SBSTA] [SBI] (December 2019).

The IPCC Special Report on The Ocean, Cryosphere and Climate Change (SROCC)

This report, centrally focused on the oceans and climate nexus, is under preparation and is due in September 2019. The report includes key chapters on Polar Regions, Sea Level Rise and Implications for Low Lying Islands, Coasts and Communities, Changing Ocean, Marine Ecosystems, and Dependent Communities, Extremes, Abrupt Changes and Managing Risks, and a Cross-Chapter Box: Low Lying Islands and Coasts.

It will be essential that this report receive careful and timely consideration in the UNFCCC process. We suggest a similar procedure for review, including parties and non-party stakeholders, as outlined above for the IPCC 1.5° Report, to be held prior to and at COP 25.

The results of these assessments could be used to ultimately develop an "Ocean Impact" scale for the main greenhouse gases, which integrates the effects of different greenhouse gases on both climate change and ocean acidification, and, as well, to understand the implications of decline in the capacity of the ocean to continue to chemically absorb carbon dioxide which would result in far faster and higher increases in global temperatures.[8]

8 Biniaz and Bodansky, August 2018

Consideration of Points Related to Oceans and Coasts in the Paris Rulebook and in the Global Stocktake

Support development in COP 24 of a Paris "Rulebook" that promotes ambition, particularly through a robust transparency framework and effective Global Stocktake, and that allows for consideration of specific ocean/coastal impacts and contributions to climate ambition in all processes, including reporting, associated with the Rulebook. As well, insure that information on the status of ocean sinks and other relevant aspects related to the climate and ocean nexus is an input into, and subject of, the Global Stocktake. Similarly, ensure that the Global Stocktake review of the "adequacy and effectiveness of adaptation and support for adaptation" includes ocean-related adaptation.

Supporting the Ocean Content and Ambition of NDCs

To support nations in enhancing the ocean content and ambition of their Nationally Determined Contributions, including mitigation measures, adaptation measures, capacity development, and assist them in obtaining the requisite financing support.

Ocean Financing

To support nations to address the multiple and difficult challenges they are facing regarding mitigation, adaptation, displacement, and capacity building related to climate change impacts on oceans, coastal zones, and coastal and island peoples. More systematic understanding of the existing patterns of financial flows must be developed, comparisons made to financial requests made in NDCs, followed by careful assessment of gaps and ways of fulfilling such gaps.

2. Connecting, on a Systematic Basis, with Other UN and Other International Developments

Work and discussions on the oceans and climate nexus taking place in the context of the UNFCCC must also be synchronized and coordinated with oceans and climate initiatives in other UN fora (e.g., the 2019 UN Secretary General's Climate Summit, the 2020 projected UN Ocean Conference, the UN Law of the Sea deliberations, work on the *Decade of Ocean Science for Sustainable Development*, implementation of Agenda 2030, and other related efforts), and with more informal efforts led by specific nations, such as the forthcoming Our Ocean conferences—in Norway in 2019 and in Palau in 2020.

1. Introduction

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 2018. 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.[9] 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.[10] 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 COP yearly;[11] working with national and local level lead-

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

10 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).

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

ers 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).

What is Progress?

Progress as it relates to ocean and climate action is sometimes difficult to define. In some areas, progress can be represented by objective, quantitative numbers, such as additional funding measured in dollars, or restored mangroves measured in acres. Wherever possible, this report attempts to report objective, quantitative values. While some of the recommendations in the Roadmap are conducive to a quantitative approach (e.g,, percentage of marine areas set aside as marine protected areas (MPAs)), on other important topics, such as progress on raising public awareness of the linkage between oceans and climate or increasing recognition of the usefulness of sustainable Blue Economy approaches, quantitative tracking is not always possible. This report discusses these cases in a qualitative manner. This report revisits each of the major themes in the Road and those covered in the Progress Report 2016-2017. Progress on each recommendation is discussed, wherever possible, with a numerical value or specific examples of on-the-ground change. For each recommendation under each theme, this report considers: 1) changes in the current status and/or science of the issue since the last COP- COP 23 in Bonn, Germany; 2) examples of the recommendation being implemented in actions by Parties, local governments, civil society, etc.; 3) changes in the state of play within the UNFCCC; 4) new opportunities and pathways within or outside of the UNFCCC that have arisen since the last COP; and 5) changes in financial considerations or significant financial pledges related to the recommendation. Not all of these items will be relevant to every recommendation, and the discussion of each recommendation will not be exhaustive due to the global nature of these efforts. For this reason, each report and the overall tracking of policy changes by ROCA is considered an open and ongoing progress. Readers are kindly invited to contact the authors with comments and contributions.

Major Topics Addressed in the Report

In the following sections, this Progress Report for 2018 addresses progress (or lack thereof) in the following categories: 2. The central role of oceans in climate and associate science and policy issues; 3. The central role of Nationally Determined Contributions; 4. Mitigation; 5. Adaptation; 6. Blue Economy; 7. Population Displacement; 8. Financing on Oceans and Climate; 9. Capacity Development; and 10. Oceans at COP 24, Katowice, Poland.

2. THE CENTRAL ROLE OF OCEANS IN CLIMATE AND ASSOCIATED SCIENCE AND POLICY ISSUES

2.1 Scientific Findings on Ocean Warming, Ocean Acidification, Ocean Deoxygenation, Multiple stressors

The ocean plays a key role in regulating climate.[12] It has absorbed ~30% of anthropogenic CO_2 emissions since 1750,[13] which mitigates atmospheric warming but directly results in ocean acidification. It has also absorbed ~93% of Earth's additional heat since the 1970s, which has caused ocean warming and decreased oxygen content or deoxygenation. The ocean is also the recipient for all the melting land-based ice and this, along with thermal expansion due to ocean warming, is causing sea levels to rise. These changes to the ocean's fundamental physics and chemistry have important consequences not only for marine biodiversity and ecosystems but also for the goods and services they provide, including protein and other nutrients from finfish and shellfish, coastal protection, and livelihoods and habitable space for hundreds of millions of people.[14] Due to a time lag in the Earth system the ocean's carbon content, oxygen, acidity, heat and sea level will continue to change long after atmospheric CO_2 is stabilized but the extent of CO_2 emission cuts will affect their magnitude.[15]

This section of the report covers progress in our understanding of and action on four key aspectss of the ocean-climate nexus: ocean warming, acidification, deoxygenation, and impacts on fisheries and aquaculture.

12 IPCC, 2013. Climate change 2013: The physical science basis. Contribution of Working Group I to the Fifth Assessment Report of the intergovernmental panel on climate change [Stocker TF, Qin D, Plattner G-K, Tignor M, Allen SK, Boschung J, Nauels A, Xia Y, Bex V, Midgley PM, editors]. Cambridge: Cambridge University Press, 1535. doi:10.1017/CBO9781107415324

13 Le Quéré et al. 2016. Global carbon budget 2016. Earth Syst Sci Data. 8(2):605–649. doi: 10.5194/essd-8-605-2016

14 Gattuso JP, Magnan A, Bille R, et al. (2015) Contrasting futures for ocean and society from different anthropogenic CO2 emissions scenarios. Science 349.

15 Royal Society 2017 Climate updates: progress since the fifth Assessment Report (AR5) of the IPCC. Issued: November 2017 DES5123 ISBN: 978-1-78252-306-2.

It also provides a discussion of the impacts of multiple stressors on marine ecosystems and covers this year's new IPCC Special Report on the Impacts of Warming of 1.5°C above pre-industrial levels. Please refer to the companion section in the *Strategic Action Report on Oceans and Climate: 2016 to 2021*[16] for more detailed information on the role of oceans in climate and viceversa.

Ocean Warming

The World Meteorological Organization (WMO) *Statement on the State of the Climate in 2017* confirmed that sea-surface temperatures in 2017 were the third warmest on record, following 2015 and 2016.[17] The WMO also found that ocean heat content for the top 2000 meters of was the highest on record in 2017. Similar data for 2018 will not be finalized until early next year.

The 2016 coral bleaching event caused by warmer surface waters proved the most severe that has been recorded, affecting around 90% of individual reefs on the Great Barrier Reef. Significant bleaching of the reef occurred for the second consecutive year in 2017, though it was not as severe as 2016.[18] If current rates of emissions continue most tropical coral reefs ecosystems are unlikely to survive the increase in sea surface temperature in the same form, with greatly diminished goods and services.[19]

If current rates of emissions continue most tropical coral reefs ecosystems are unlikely to survive the increase in sea surface temperature in the same form

Extensive kelp forests have become degraded with rocky reefs overgrown by turf algae[20] in warmer waters. Warming is shifting the distribution of many species as they seek their optimal temperatures, and as higher water temperatures alter the habitats on which they depend novel interactions between previously separated species have the potential to transform entire ecological communities[21] and shifts of fishing grounds towards higher latitudes[22] with decreases in fisheries production in some low-latitude countries.[23] Locations for mariculture are expected to be altered, also resulting in changes in yield patterns among countries.[24]

Increased ocean heat content is predicted to intensify tropical storms,[25] and both 2017 and 2018 were exceptional years of tropical storms. The 2017 Atlantic hurricane season was the only season on record to include three hurricanes with an "exceptionally high" Accumulated Cyclone Energy (ACE) of more than 40 (hurricanes Irma, Jose, and Maria). At the time of this report's writing, the 2018 hurricane season has not ended. The 2018 Pacific hurricane season produced the highest ACE value ever recorded in the Eastern Pacific, and is tied with 1994 and 2002 for the most number of category 5 hurricanes in the region. In May 2018, tropical storm Alberto formed in the Atlantic, marking the fourth year in a row that a tropical storm formed prior to the official start of hurricane season. Hurricane Michael was the third most intense hurricane ever to make landfall in the United States. In September 2018, Hurricane Florence broke rainfall records in several locations across the east coast of the United States.

The Atlantic meridional overturning circulation (AMOC) is a large pattern of ocean circulation which regulates climate in countries with an Atlantic coast; the phenomenon known as the Gulf Stream is a well-known portion of the AMOC. In 2018, researchers found that the AMOC is the weakest that it has ever been in the last 1,600 years.[26] They suggest the most likely causes are lagging effects of freshwater input at the end of the Little Ice Age in the 1850s and 20th century melting of the Greenland Ice Sheet. In October 2018, Arctic sea ice extent was the third lowest on record for that month.[27]

Ocean Acidification

Absorbed CO_2 reacts with seawater and changes the chemistry of the ocean. The resultant decrease in seawater pH is linked to shifts in carbonate chemistry parameters, such as

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

17 WMO, 2018. Statement on the State of the Global Climate in 2017. https://library.wmo.int/doc_num.php?explnum_id=4453

18 Australian Research Council (ARC) Centre of Excellence, Coral Reef Studies, https://www.coralcoe.org.au/.

19 Hoegh-Guldberg O, Poloczanska ES, Skirving W, Dove S. 2017 Coral Reef Ecosystems under Climate Change and Ocean Acidification. Frontiers in Marine Science. May 29;4:158.

20 Filbee-Dexter K, Feehan CJ, Scheibling RE (2016) Large-scale degradation of a kelp ecosystem in an ocean warming hotspot. Mar Ecol Prog Ser 543:141-152. https://doi.org/10.3354/meps11554

21 Adriana Vergés, Christopher Doropoulos, Hamish A. Malcolm, Mathew Skye, Marina Garcia-Pizá, Ezequiel M. Marzinelli, Alexandra H. Campbell, EnricBallesteros, Andrew S. Hoey, Ana Vila-Concejo, Yves-Marie Bozec, Peter D.Steinberg. Ocean warming, enhanced herbivory and kelp loss. Proceedings of the National Academy of Sciences Nov 2016, 113 (48) 13791-13796; DOI:10.1073/pnas.1610725113

22 Cheung WW, Brodeur RD, Okey TA and Pauly D. (2015) Projecting future changes in distributions of pelagic fish species of Northeast Pacific shelf seas. Progress in Oceanography, 130, 19-31.

23 Monllor-Hurtado A, Pennino MG, Sanchez-Lizaso JL. (2017) Shift in tuna catches due to ocean warming. PloS one. Jun 7;12(6):e0178196.

24 Golden CD, Allison EH, Cheung WW, et al. (2016) Fall in fish catch threatens human health. Nature, 534(7607), 317-320.

25 IPCC, 2013. Climate change 2013: The physical science basis. Contribution of Working Group I to the Fifth Assessment Report of the intergovernmental panel on climate change [Stocker TF, Qin D, Plattner G-K, Tignor M, Allen SK, Boschung J, Nauels A, Xia Y, Bex V, Midgley PM, editors]. Cambridge: Cambridge University Press, 1535. doi:10.1017/CBO9781107415324

26 Thornalley, D.J.R., Oppo, D.W., Ortega, P., Robson, J.I., Brierley, C.M., Davis, R., et al. (2018). Anomalously weak Labrador Sea convection and Atlantic overturning during the past 150 years. Nature 556: 227-230.

27 National Snow and Ice Data Center (NSIDC). November 2018. "Arctic Sea Ice News and Analysis." Retrieved from http://nsidc.org/arcticseaicenews/.

the saturation state of aragonite, the main form of calcium carbonite used for the formation of shells and skeletal material. Changes in the concentration of aragonite have negative consequences for organisms using aragonite, such as shelled mollusks and reef-building corals, making it more difficult for them to build and in particular maintain these structures. CO_2 concentration and pH on the other hand affect the energy budget of marine life, required to reproduce and grow.

In 2018, researchers found that the AMOC is the weakest that it has ever been in the last 1,600 years…while Arctic sea ice extent was the third lowest on record for the month of October.

Understanding of ocean acidification and its impacts has significantly improved through greater geographical coverage of integrated chemical and biological observations. New meta-analyses and assessments have confirmed the academic community's previous understanding of ocean acidification and its impacts and have also provided additional insights.[28,29,30] New studies have demonstrated variability in environmental conditions especially in shelf seas,[31] and in biological responses to changing ocean chemistry,[32,33,34] as well as the complexity of multi-stressor interactions.[35] Other studies have shown that aragonite under-saturation is occurring in Arctic waters[36] and is imminent in the Southern Ocean,[37] tropical coral reefs are growing slower;[38,39] oyster hatcheries are being impacted[40] and the shells of key food web organisms are dissolving.[41]

Observations from open ocean sources over the last 20 to 30 years have shown a clear trend of decreasing pH (Figure 1). Trends in coastal locations, however, are more difficult to uncover, and characterizing coastal acidification will be a challenge for the scientific community in the coming years. The complexity is mainly due to the highly dynamic coastal environment, where a great many influences such as temperature changes, freshwater run-off, nutrient influx, biological activity and large ocean oscillations affect the carbon dioxide levels at differing scales. In order to characterize the variability of ocean acidification, and to identify the drivers and impacts, a high temporal and spatial resolution of observations is crucial.

At the current rate of CO_2 emissions, the mean surface pH is predicted to decrease by another 0.3 to 0.4 units, the equivalent to a 100-150% increase in acidity, by the end of the century. The interaction with additional stressors on the ocean, such as temperature changes, pollution and deoxygenation could further magnify the impacts of ocean acidification.

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Numerous organizations have brought together scientific and policy experts to understand and combat ocean acidification. The International Alliance to Combat Ocean Acidification (OA Alliance)[42] was established in December 2016 in direct response to the observed im-

28 CBD (Convention on Biological Diversity). (2014) An Updated Synthesis of the Impacts of Ocean Acidification on Marine Biodiversity. Eds: S Hennige, JM Roberts & P Williamson. Montreal, CBD Technical Series No. 75; 99 pp.

29 Gattuso JP, Magnan A, Bille R, et al. (2015) Contrasting futures for ocean and society from different anthropogenic CO2 emissions scenarios. Science 349.

30 Nagelkerken I and Connell SD. (2015) Global alteration of ocean ecosystem functioning due to increasing human CO2 emissions. Proceedings of the National Academy of Sciences of the United States of America 112: 13272-13277.

31 Ostle C, Williamson P, Artioli Y, et al. (2016). Carbon dioxide and ocean acidification observations in UK waters. Synthesis report with a focus on 2010–2015. University of East Anglia, DOI:10.13140/RG.2.1.4819.4164, https://ueaeprints.uea.ac.uk/id/eprint/59604

32 Hall-Spencer JM and Allen R. (2015) The impact of CO2 emissions on 'nuisance' marine species. Research and Reports in Biodiversity Studies 4: 33-46, doi: 10.2147/RRBS.S70357:

33 Nagelkerken I and Munday PL (2016). Animal behaviour shapes the ecological effects of ocean acidification and warming: moving from individual to community-level responses. Global Change Biology 22: 974-89.

34 Ellis RP, Davison W, Queirós AM, et al. (2017) Does sex really matter? Explaining intraspecies variation in ocean acidification responses. Biology Letters, 13: 20160761:

35 Calosi P, Melatunan S, Turner LM, et al. (2017) Regional adaptation defines sensitivity to future ocean acidification. Nature Communications 8: 13994.

36 Qi D, Chen L, Chen B, et al. (2017) Increase in acidifying water in the western Arctic Ocean. Nature Climate Change 7: 195-9.

37 Hauri C, Friedrich T and Timmermann A. (2016) Abrupt onset and prolongation of aragonite undersaturation events in the Southern Ocean. Nature Climate Change 6: 172-+.

38 Albright R, Caldeira L, Hosfelt J, et al. (2016) Reversal of ocean acidification enhances net coral reef calcification. Nature 531: 362-365; doi: 310.1038/nature17155.

39 Silverman J, Schneider K, Kline DI, et al. (2014) Community calcification in Lizard Island, Great Barrier Reef: A 33 year perspective. Geochimica Et Cosmochimica Acta 144: 72-81:

40 Barton A, Waldbusser GG, Feely RA, et al. (2015) Impacts of Coastal Acidification on the Pacific Northwest Shellfish Industry and Adaptation Strategies Implemented in Response. Oceanography 28: 146-159.

41 Bednaršsek N, Tarling GA, Bakker DCE, et al. (2014) Dissolution dominating calcification process in polar pteropods close to the point of aragonite undersaturation, Plos One 9.

42 https://www.oaalliance.org/

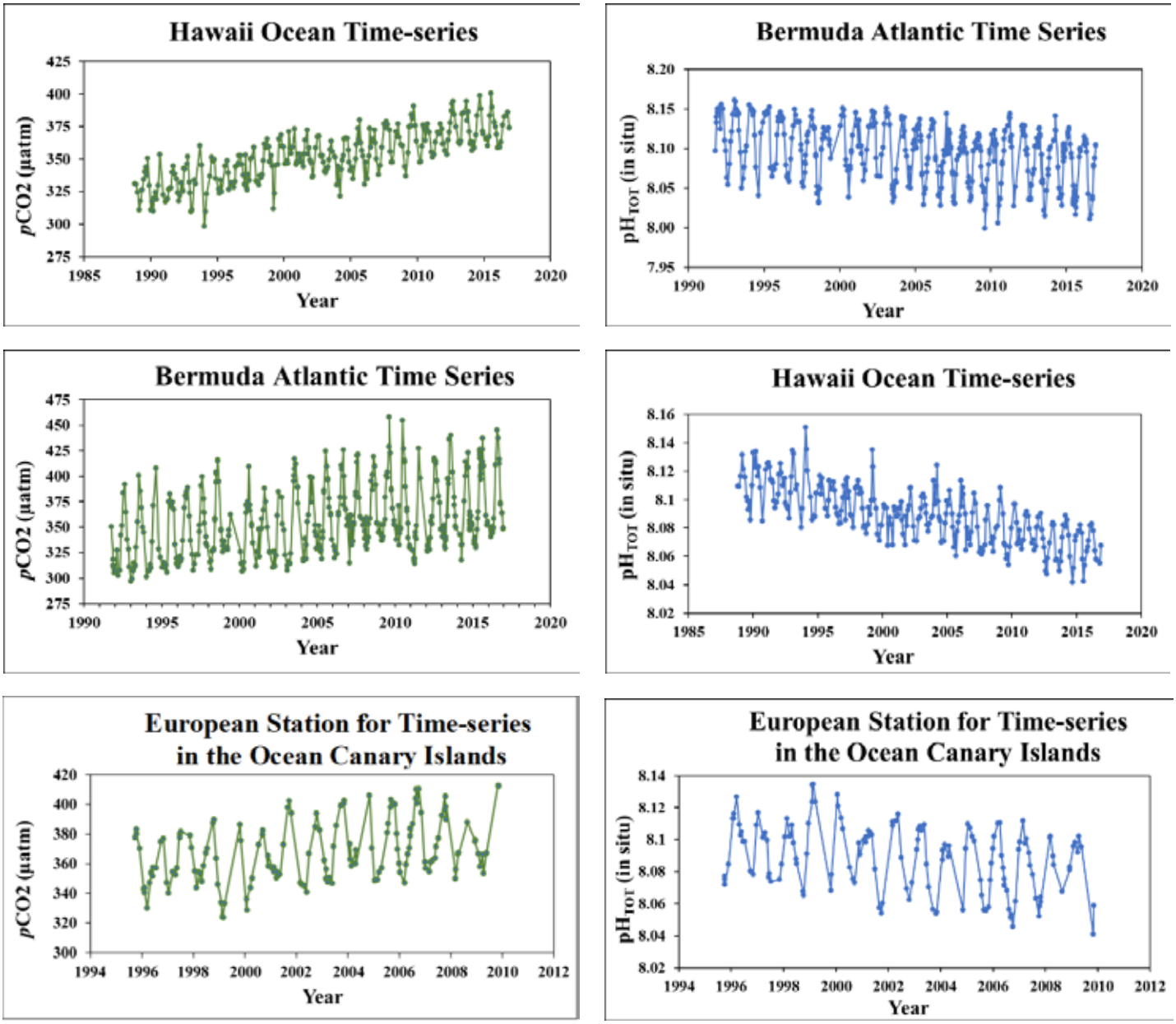

Figure 1: pCO2 and pH records from three long-term ocean observation stations. Top: Hawaii Ocean Time-Series (HOTS) in the Pacific Ocean; Middle: Bermuda Atlantic Time Series (BATS); Bottom: European Station for Time-Series in the Ocean Canary Islands (ESTOC) in the Atlantic Ocean. Credit: Richard Feely (NOAA- PMEL) and Marine Lebrec (IAEA OA-ICC).

pacts of ocean acidification in the mid-2000s to oyster hatchery production across the North American West Coast. The intent of the OA Alliance is to motivate governments to proactively respond to the impacts of ocean acidification by charting a course of action for sustaining coastal communities and livelihoods. OA Alliance members are working together to elevate the issue of ocean acidification and develop OA Action Plans that contain practicable, implementable steps to mitigate causes, to adapt to unavoidable change and to build resiliency in marine ecosystems and the coastal communities impacted by changing ocean conditions.

Since its launch, the OA Alliance has grown to over 70 members, including 11 national governments, 8 states, 2 provinces, 5 tribal nations, and 4 cities, along with research institutions, businesses and NGOs. In 2017 and 2018, New Zealand and the U.S. states of Washington and California have each released a government led OA Action Plan under the OA Alliance framework and many more members have action plans under way. The OA Alliance is on track to meet its commitment to develop 15 OA Action Plans by end of 2019. In September, the OA Alliance contributed to and was featured prominently at the Global Climate Action Summit in San Francisco, hosting an affiliate event that: 1) showcased national and subnational commitments to addressing ocean acidification; 2) presented approaches for responding to the science of ocean acidification through the creation of OA Action Plans; and 3) invited Global Climate Action Summit participants to make commitments to address ocean acidification and other changing ocean conditions within climate agreement frameworks.

It is expected that the newly introduced Methodology for the Sustainable Development Goal (SDG) Indicator

14.3.1 ("Average marine acidity (pH) measured at agreed suite of representative sampling stations") will lead to an expansion in the observation of ocean acidification on a global level. This methodology was developed in 2017 and 2018 by the indicator custodian agency, IOC-UNESCO, with input from international scientific experts at the Global Ocean Acidification Observing Network (GOA-ON), and sets standards for the measurement and management of ocean acidification data.

The Alliance to Combat Ocean Acidification is on track to meet its commitment to develop 15 OA Action Plans by the end of 2019.

Ocean Deoxygenation

Both observations and numerical models indicate that oxygen is declining in the modern open and coastal ocean, including estuaries and semi-enclosed seas. Since the middle of the last century, there has been an estimated 1-2 % decrease (i.e. 2.4-4.8 Pmol or 77-145 billions tons) in the global ocean oxygen inventory,[43,44] while, in the coastal zone, many hundreds of sites are known to have experienced oxygen concentrations that impair biological processes or are lethal for many organisms. Recent analysis of extensive observational data sets indicate that deoxygenation is occurring more rapidly than previously expected[45] with up to a 2% loss of oxygen since 1960,[46] although biogeochemical feedbacks remain unclear.[47]

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Deoxygenation is important in both coastal and open water environments.[48] An anthropogenic deoxygenation signal is already observable.[49] While the relative importance of the various mechanisms responsible for the loss of the global ocean oxygen content is not precisely known, global warming is expected to contribute to this decrease directly because the solubility of oxygen decreases in warmer waters, and indirectly through changes in ocean dynamics that reduce ocean ventilation, the introduction of oxygen to the ocean interior. In some regions the "metabolic index" (based on metabolic oxygen demand for different animals) is projected to decline greatly (by ~50% for unabated emissions).[50] Deoxygenation will likely negatively impact demersal community structure, diversity and fisheries that rely on more aerobically active and muscular species of fish.[51]

The volume of anoxic regions of the ocean's oxygen minimum zones has expanded since 1960,[52] altering biogeochemical pathways by allowing processes that consume fixed nitrogen and release phosphate, iron, H_2S, and possibly, N_2O. The relatively small inventory of essential elements, like nitrogen and phosphorus, makes such alterations capable of perturbing the equilibrium chemical composition of the ocean. Positive feedback

43 Bopp L, Resplandy J, Doney S, Dunne J, Gehlen M, Halloran P, Heinze C, Ilyina T, Seferian R, Tjiputra J, Vichi M. (2013). Multiple stressors of ocean ecosystems in the 21st century: projections with CMIP5 models. Biogeosciences, 10, 6225–6245, 2013

44 Schmidtko S, Stramma L, and Visbeck M. (2017). Decline in global oceanic oxygen content during the past five decades. Nature volume 542, pages 335–339

45 Ito T, Minobe S, Long MC and Deutsch C. (2017) Upper ocean O2 trends: 1958–2015. Geophysical Research Letters, 44(9), 4214-4223.

46 Schmidtko S, Stramma L and Visbeck M (2017) Decline in global oceanic oxygen content during the past five decades. Nature, 542(7641), pp.335-339.

47 Niemeyer D, Kemena TP, Meissner KJ and Oschlies A. (2017) A model study of warming-induced phosphorus-oxygen feedbacks in open-ocean oxygen minimum zones on millennial timescales. Earth System Dynamics. May 19;8(2):357-67.

48 Levin LA and Breitburg DL. (2015) Linking coasts and seas to address ocean deoxygenation. Nature Climate Change, May 1;5(5):401.

49 Long MC, Deutsch C and Ito T. (2016) Finding forced trends in oceanic oxygen. Global Biogeochemical Cycles, 30(2), pp.381-397.

50 Deutsch C, Ferrel A, Seibel B, et al. (2015) Climate change tightens a metabolic constraint on marine habitats. Science, 348(6239), pp.1132-1135:

51 Gallo ND and Levin LA. (2016) Fish Ecology and Evolution in the World's Oxygen Minimum Zones and Implications of Ocean Deoxygenation. Advances in Marine Biology, 74, 117-198.

52 Schmidtko S, Stramma L, and Visbeck M. (2017). Decline in global oceanic oxygen content during the past five decades. Nature volume 542, pages 335–339

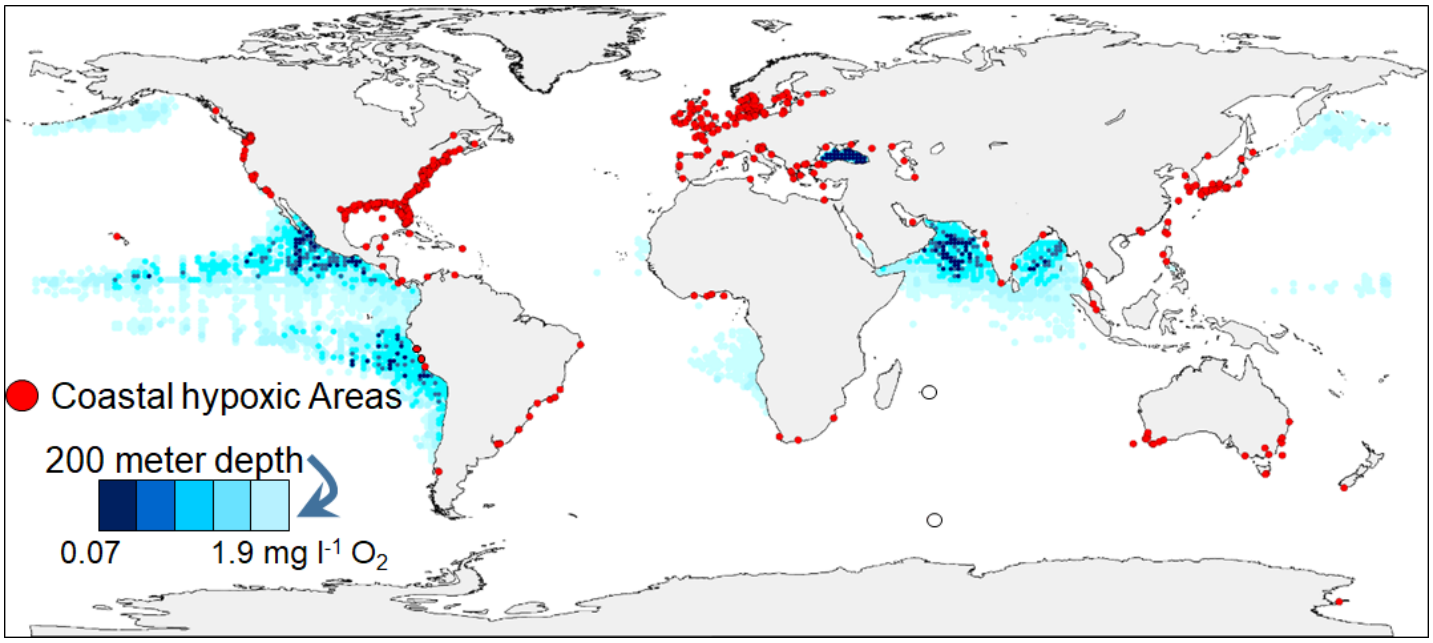


Figure 2. OMZs (blue) and areas with coastal hypoxia (red) in the world's oceans. Coastal hypoxic sites mapped here are systems where oxygen concentrations < 2 mg/L have been recorded and in which anthropogenic nutrients are a major cause of oxygen decline (data from Diaz and Rosenberg, 2008 and Diaz, unpublished. Figure adapted after Isensee et al., 2015, GO$_2$NE 2018.

loops (e.g. remobilization of phosphorus and iron from sediment particles) may speed up the run away from equilibrium in a way that we hardly know.

The Global Ocean Oxygen Network (GO$_2$NE), established in June 2016 at the 49th session of the IOC-UNESCO Executive Council, published a technical brief 'The ocean is losing its breath' in July 2018. The summary for policymakers is a useful overview of the state of deoxygenation (Figure 2), its causes, and options to address it.[53]

Multiple Stressors

The scientific community has increasingly focused on assessing and modelling the impacts of multiple stressors on marine ecosystems, biodiversity, and resources. Including multiple stressors in studies allows scientists to get a more accurate picture of the actual conditions experienced by marine species and ecosystems. Studies on the effects of the multiple stressors have indicate that the scale of adverse biodiversity, ecosystem and fisheries impacts will be influenced by many factors, including complex and not fully understood interactions between ocean warming, acidification and deoxygenation[54] and other non-climate stressors (pollution and over-exploitation and destructive fishing practices).

Local variability in conditions and species' responses and adaptation potential, predator-prey interactions, migration of species and complex food-web effects could affect marine biodiversity, habitats and ecosystems and dependent fisheries.[55] There is potential for an overall simplification, through reduction in species, or even loss of some ecosystems, such as those supported by corals, with reduced energy flow between food web organisms and little scope for some species to acclimate.[56]

Studies on the effects of multiple stressors have indicated that the scale of adverse biodiversity, ecosystem and fisheries impacts will be influenced by many factors, including complex and not fully understood interactions between ocean warming, acidification and deoxygenation, as well as pollution, over-exploitation and destructive fishing practices.

There is increasing evidence that continuation of the current rate of emissions will rapidly and significantly alter many ecosystems and food webs through increased warming, acidification and deoxygenation and the spread of oxygen minimum zones or their combination. These stressors can represent high or very high risk to fin fisheries and shellfish aquaculture in vulnerable regions.[57] A low emissions scenario (consistent with

53 Breitburg, D., Grégoire, M. and Isensee, K. (eds.). Global Ocean Oxygen Network. (2018). The ocean is losing its breath: Declining oxygen in the world's ocean and coastal waters. IOC-UNESCO, IOC Technical Series, No. 137 40pp. http://unesdoc.unesco.org/images/0026/002651/265196e.pdf

54 Kroeker KJ, Kordas RL and Harley CD (2017) Embracing interactions in ocean acidification research: confronting multiple stressor scenarios and context dependence. Biology Letters 13: 20160802.

55 Howes EL, Joos F, Eakin CM, et al. (2015) An updated synthesis of the observed and projected impacts of climate change on the chemical, physical and biological processes in the oceans. Frontiers in Marine Science 2: doi: 10.3389/fmars.2015.00036.

56 Nagelkerken I and Connell SD. (2015) Global alteration of ocean ecosystem functioning due to increasing human CO2 emissions. Proceedings of the National Academy of Sciences of the United States of America 112: 13272-13277.

57 Gattuso JP, Magnan A, Bille R, et al. (2015) Contrasting futures for ocean and society from different anthropogenic CO2 emissions scenarios. Science 349.

keeping global temperature increase below 2°C) reduces risk considerably but not entirely, for example risk to coral ecosystems under the low emissions scenario is high.[58] The potential loss of tropical coral reefs would not just reduce local biodiversity due to loss or reduction of the complex habitat structures they provide but would also have major consequences for coastal protection, tourism, income, livelihoods and fisheries.[59,60]

2.2 Impacts of Climate Change on Fisheries and Aquaculture

The Food and Agriculture Organization of the UN (FAO) provided a comprehensive view of the impacts of climate change on fisheries and aquaculture in most regions of the world in a recently released Technical Paper,[61] reflecting the complex picture of current and potential future trends. The Technical Paper recognizes the importance of contextualizing the topic of climate change in fisheries and aquaculture in terms of poverty alleviation and the existing policy commitments such as UN Agenda 2030 and the Paris Climate Agreement, and on our current and expected socio-economic dependencies on the sector. It was designed to include marine and inland capture fisheries, as well as aquaculture, recognizing that the level of evidence and responses at global, regional and national scales will differ between sub-sectors. The Technical Paper also addresses disasters and extreme events and health and food safety hazards in addition to the impacts of long-term patterns of change.

58 ibid.

59 CBD (Convention on Biological Diversity). (2014) An Updated Synthesis of the Impacts of Ocean Acidification on Marine Biodiversity. Eds: S Hennige, JM Roberts & P Williamson. Montreal, CBD Technical Series No. 75; 99 pp.

60 Hoegh-Guldberg O, Poloczanska ES, Skirving W, Dove S. 2017 Coral Reef Ecosystems under Climate Change and Ocean Acidification. Frontiers in Marine Science. May 29;4:158.

61 Barange, M., Bahri, T., Beveridge, M., Cochrane, K., Funge-Smith, S., Poulain, F. (Eds.). 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. http://www.fao.org/3/I9705EN/i9705en.pdf (full version) http://www.fao.org/3/CA0356EN/ca0356en.pdf (summary in English)

All pieces of evidence were translated into effective and explicit adaptation and mitigation strategies and tools in the Technical Paper, taking also into consideration the potential adaptations to climate change from other sectors. Climate change is already affecting or is very likely to significantly affect the fisheries and aquaculture sector at many levels, both directly (e.g. frequency/ intensity of natural disasters and extreme weather events) and indirectly (e.g. changes in productivity and habitats, shifts in the distribution of fish populations,). While in some cases opportunities may arise from climate change, negative impacts are expected to be predominant.

Climate change is already affecting or is very likely to significantly affect the fisheries and aquaculture sector at many levels, both directly (e.g. frequency/ intensity of natural disasters and extreme weather events) and indirectly (e.g. changes in productivity and habitats, shifts in the distribution of fish populations). Negative impacts are expected to be predominant.

Shifts in the distribution of species of importance to fisheries are one of the most widely recognized and acknowledged impacts of climate change on the oceans, leading to profound changes in the production of fish species with important impacts on fisheries and their management. Climate change has already caused noticeable shifts in the distribution and abundance of highly distributed fish species, such as tunas, and substantial future changes can be expected under a warming climate with important impacts on national incomes of dependent countries and for the harvest strategies currently being used for their management.

Climate change impacts on aquaculture include losses of production and infrastructure arising from extreme events such as floods, increased risk of diseases, parasites and harmful algal blooms (HABs) and reduced production because of negative impacts on farming conditions. In the long-term, impacts include reduced availability of wild seed, as well as reduced precipitation leading to increasing competition for freshwater.

It is clear that these changes will potentially have both favourable and unfavourable impacts on fisheries and aquaculture, but the available information indicates that unfavourable changes are likely to outweigh favourable ones, particularly in developing countries where adaptive capacity is typically weakest. Analysis of data on dietary nutrition and the decline in fish catch indicates that the nutrition (protein and micronutrient supply) of about 1.4 billion people is at risk because fish make up >20% of their animal-based food by weight.[62]

62 Golden CD, Allison EH, Cheung WW, et al. (2016) Fall in fish catch threatens human health. Nature, 534(7607), 317-320.

Destructive fishing practices, industrial pollution, coastal development and climate change contribute to the decline. Climate change under a high emissions scenario is projected to reduce fish catch globally by 6% and by 30% in tropical regions by 2050[63] where, due to their dependency on wild fish[64] and their poor current adaptive capacity,[65] the most vulnerable communities live. The combined impacts of warming, deoxygenation and acidification on marine ecosystems and fisheries may lead to a more adverse risk assessment.

Declining fish catch indicates that the nutrition of about 1.4 billion people is at risk because fish make up over 20% of their animal-based food by weight.

At the societal level, climate change affects small-scale fishing and fish farming communities in developing countries. These are often marginalized and at the bottom of the socio-economic ladder. Small-scale fishers and fish farmers are particularly vulnerable to climate change as a result of both their geographical location and their poverty situation. Being located at the waterfront, fishing and fish farming communities are exposed to climate related extreme events and natural hazards, such as hurricanes, cyclones, sea level rise, ocean acidification, floods and coastal erosion. Millions of people living in coastal and floodplain lowlands are unable to escape regular flooding.

A challenge going forward will be the inclusion of climate impacts on fisheries and aquaculture in policies and management plans. The goal of fisheries and aquaculture policies, as outlined in the FAO Code of Conduct for Responsible Fisheries and related instruments, is to be ecologically, economically and socially sustainable while providing a source of healthy food.

Although fisheries and aquaculture contribute little to greenhouse gas emissions, it is generally recommended that both mitigation and adaptation approaches be integrated into sectoral policies to avoid inconsistencies. Climate change adaptation policies require flexibility to take into account future climate and uncertainties. These policies contribute to increasing institutional and management adaptation, livelihood adaptation and resilience[66] including technical, administrative, organizational and communication capacity. Such policies also need to address poverty, as the ability of

Box 2.1. Long-term recommendations for effective fisheries and aquaculture policies to address climate change impacts

In practice, all of this translates into sectoral policies aimed at:

- Broadening the policy framework and including fisheries and aquaculture in Intended Nationally Determined Contributions (INDCs) and National Adaptation Plans (NAPs) to ensure the sector is mainstreamed into domestic climate change policies and can access funding.
- Enabling national legal and policy-making framework, mainly pro-poor policies, to help lift communities out of poverty through the targeted provision of services to prevent the relapse of communities into poverty, while ensuring that women are fully engaged in the actions undertaken.
- Developing public policies that promote investment in research, communication, exchange of information and good practices, development and commercialization of innovative fisheries and aquaculture products.
- Encouraging / strengthening integrated policies and approaches across sectors (fisheries, aquaculture, development, recreation, tourism, oil and gas extraction, etc.).
- Coordinating national fisheries policies at the regional level to take into account the movement of species and people in response to the effects of climate change.
- Integrating risks into sectoral policies (e.g. safety at sea, social protection, insurance, contingency planning) to reduce / manage current and future risks.
- Linking climate mitigation and adaptation measures to national policies on sustainable development in the fisheries and aquaculture sector and ensuring that they are inclusive and address poverty, in line with the Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries in the Context of Food Security and Poverty Eradication (the SSF Guidelines).
- Avoiding maladaptation, i.e. policies with short-term goals or lack of policies that may increase the risk of adverse effects.

63 Cheung WW, Jones MC, Reygondeau G, et al. (2016) Structural uncertainty in projecting global fisheries catches under climate change. Ecological Modelling. 2016 Apr 10;325:57-66.
64 Golden CD, Allison EH, Cheung WW, et al. (2016) Fall in fish catch threatens human health. Nature, 534(7607), 317-320.
65 Whitney CK, Bennett NJ, Ban NC, et al. (2017) Adaptive capacity: from assessment to action in coastal social ecological systems. Ecology and Society 22(2):22. https://doi.org/10.5751/ES-09325-220222.
66 FAO Adaptation Toolbox as developed in Chapter 25 of Barange et al. 2018

individuals and communities to adapt to climate change depends on their vulnerability, exposure and adaptive capacity, which in turn, is related to their financial and social capital.

Effective climate change policies for fisheries and aquaculture need to: take an explicit ecosystem approach; address poverty and vulnerability; enhance resilience; have both a short term and long-term focus; support adaptive management; integrate multiple sectors and scales; and include monitoring and review. They should be developed with effective and inclusive engagement and accountability of stakeholders. Policy makers will need tools to be able to cope with uncertainties associated with costs and benefits of actions taken to adapt to climate change.

2.3 Key New Scientific Reports--IPCC 1.5˚ C Report, US National Climate Assessment Report, Forthcoming IPCC Report on the Ocean, the Cryosphere, and Climate Change

In 2017 and 2018, scientists continued to emphasize that the effects of climate change are already being felt, with significant negative impacts on marine life and island and coastal human populations. The IPCC released a Special Report on the Impacts of Global Warming of 1.5°C above pre-industrial levels (IPCC SR1.5) in 2018.[67] The report found that to achieve a medium chance of limiting warming to 1.5°C, the world can only emit 770 additional gigatonnes of carbon dioxide. If all countries meet their Paris Agreement goals, that "carbon budget" will be spent by 2030. This finding indicates that drastic and ambitious carbon emissions reductions, beyond what is pledge in the Paris Agreement, are needed to safely keep warming below 1.5°C above pre-industrial levels. The IPCC states that the world will need to reach net zero emissions before mid-century, and will likely need to have some net negative emissions, in order to keep warming below 1.5°C in the long term. The SR1.5 shows that while warming of 1.5°C will not avoid all damages, it will significantly reduce negative impacts in comparison to 2°C and higher. In summary, the scientific community sent a clear message in 2018 that dangerous effects of climate change are already being felt worldwide, and action must be ambitious and accelerated if the global community is to avoid significantly more drastic consequences by keeping warming to 1.5°C.

The report is extensively quoted below, to give an overview of its findings. The IPCC gives statements confidence levels using "very high, high, medium, low, and very low," wherein confidence levels correspond to both the amount of available evidence and the degree of agreement among experts. "Very high confidence" represents a great deal of evidence and virtually complete consensus among experts.

Drastic and ambitious carbon emissions reductions, beyond what is pledged in the Paris Agreement, are needed to safely keep warming below 1.5°C above pre-industrial levels.

"Limiting global warming to 1.5°C compared to 2°C is projected to reduce increases in ocean temperature as well as associated increases in ocean acidity and decreases in ocean oxygen levels (high confidence). Consequently, limiting global warming to 1.5°C is projected to reduce risks to marine biodiversity, fisheries, and ecosystems, and their functions and services to humans, as illustrated by recent changes to Arctic sea ice and warm water coral reef ecosystems (high confidence)."

"On longer time scales, sustained net negative global anthropogenic CO_2 emissions and/ or further reductions in non-CO_2 radiative forcing may still be required to prevent further warming due to Earth system feedbacks and to reverse ocean acidification (medium confidence) and will be required to minimize sea level rise (high confidence)."

"Human-induced global warming has already caused multiple observed changes in the climate system (high confidence). In particular, this includes increases in both land and ocean temperatures, as well as more frequent heatwaves in most land regions (high confidence). There is also high confidence that it has caused an increase in the frequency and duration of marine heatwaves."

"Global mean sea level rise will be around 0.1 m less by the end of the century in a 1.5°C world as compared to a 2°C warmer world (medium confidence). Reduced sea level rise could mean that up to 10.4 million fewer people (based on the 2010 global population and assuming no adaptation) are exposed to the impacts of sea level globally in 2100 at 1.5°C as compared to 2°C. A slower rate of sea level rise enables greater opportunities for adaptation (medium confidence). There is high confidence that sea level rise will continue beyond 2100. Instabilities exist for both the Greenland and Antarctic ice sheets that could result in multi-meter rises in sea level on centennial to millennial timescales. There is medium confidence that these instabilities could be triggered under 1.5° to 2°C of global warming."

"…Multiple lines of evidence reveal that ocean warming and acidification (corresponding to global warming of

67 IPCC, 2018: Summary for Policymakers. In: Global warming of 1.5°C. [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.)]. World Meteorological Organization, Geneva, Switzerland, 32 pp. http://www.ipcc.ch/pdf/special-reports/sr15/sr15_spm_final.pdf

1.5°C of global warming) is expected to impact a wide range of marine organisms, ecosystems, as well as sectors such as aquaculture and fisheries (high confidence)"

"Ocean ecosystems are experiencing large-scale changes, with critical thresholds expected to be reached at 1.5°C and above (high confidence). In the transition to 1.5°C, changes to water temperatures will drive some species (e.g. plankton, fish) to relocate to higher latitudes and for novel ecosystems to appear (high confidence). Other ecosystems (e.g. kelp forests, coral reefs) are relatively less able to move, however, and will experience high rates of mortality and loss (very high confidence). For example, multiple lines of evidence indicate that the majority of warmer water coral reefs that exist today (70-90%) will largely disappear when global warming exceeds 1.5°C (very high confidence)."

"Current ecosystem services from the ocean will be reduced at 1.5°C, with losses being greater at 2°C (high confidence). The risks of declining ocean productivity, shifts of species to higher latitudes, damage to ecosystems (e.g. coral reefs, and mangroves, seagrass and other wetland ecosystems), loss of fisheries productivity (at low latitudes), and changing ocean chemistry (e.g., acidification, hypoxia, dead zones), however, are projected to be substantially lower when global warming is limited to 1.5°C (high confidence)."

It is clear from the IPCC SR1.5 that ocean ecosystems are already experiencing rapid change and that the world needs to achieve no more than 1.5°C mean global warming for ocean ecosystems and the human services they provide to be severely threatened.

According to the Fourth US National Climate Assessment Report, many coastal regions in the US would be utterly transformed by the end of the century, through a combination of ocean warming, sea level rise, ocean acidification, coastal erosion, more intense storm surge, and an increased number of heavy precipitation events.

The conclusions in the Fourth U.S. National Climate Assessment (NCA4), released in November 2018 by the U.S. Global Change Research Program (USGCRP), noted, in particular, that negative impacts of climate change are not a hypothetical future scenario but are already causing damages to U.S. lives and livelihoods.[68] The NCA4 stated that many coastal regions in the country would be utterly transformed by the end of the century, through a combination of ocean warming, sea level rise, ocean acidification, coastal erosion, more intense storm surge, and an increased number of heavy precipitation events. In particular, coral reef and Arctic ecosystems are already experiencing significant impacts, which has already been detrimental to the economies which depend on their health. The findings on a national level are in line with IPCC findings on a global scale.

2.4 Updates on the Paris Agreement, UN Processes, and Other International Policy Efforts

Since the 2016-2017 ROCA Progress Report, an additional 17 Parties have ratified the Paris Agreement, bringing the total to 179 Parties out of 195 Party signatories. The forty-eighth sessions of the UNFCCC Subsidiary Body for Implementation (SBI 48), the Subsidiary Body for Scientific and Technological Advice (SBSTA 48), and the fifth part of the first session of the Ad Hoc Working Group on the Paris Agreement (APA 1-5) took place from 30 April to 10 May 2018 in Bonn, Germany. The sessions can be collectively referred to as the "Bonn Climate Change Conference," and this year the three Subsidiary Bodies made significant progress on developing the Paris Agreement Work Programme (PAWP).[69] The PAWP operationalizes the components of the Paris Agreement, and it is expected to be adopted at the 24th session of the UNFCCC Conference of the Parties (COP 24) in Katowice, Poland, in December 2018. The preparatory phase of the Talanoa Dialogue occurred in conjunction with the Bonn Climate Change Conference. The Talanoa Dialogue process is discussed in detail in the section on the Central Role of Nationally Determined Contributions.

In order to ensure the readiness of the PAWP for COP 24, the Subsidiary Bodies agreed to hold another negotiation session in Bangkok, Thailand from 3-8 September. Issues discussed at the Bangkok session included the Nationally Determined Contribution (NDC) registry, the Adaptation Communications Registry, and finance and cooperative approaches.[70] Outcomes included joint reflections by the presiding officers of the three Subsidiary bodies and a 307-page "PAWP compilation," which provides detailed guidance on specific aspects of the PAWP for discussion at COP 24.

The IPCC Special Report on the Ocean, Cryosphere and Climate Change (SROCC) is due September 2019 with key chapters on Polar Regions, Sea Level Rise and Implications for Low Lying Islands, Coasts and Communities, Changing Ocean, Marine Ecosystems, and Dependent Communities, Extremes, Abrupt Changes and Managing Risks, and a Cross-Chapter Box: Low Lying Islands and Coasts. The three Working Group contributions to the IPCC 6th Assessment Report (AR6) will be finalized in 2021 and the AR6 Synthesis Report in the first half of 2022.

68 https://nca2018.globalchange.gov/

69 IISD, 2018. "Bonn Climate Change Conference Advances Work on Paris Agreement Work Programme, Negotiations to Resume in September." http://sdg.iisd.org/news/bonn-climate-change-conference-advances-work-on-pawp-negotiations-to-resume-in-september/

70 IISD, 2018. "Bangkok Climate Change Conference 2018." http://enb.iisd.org/climate/sb48-2/

Oceans and the Law of the Sea[71]

In December 2017, the General Assembly of the United Nations (UNGA) held the eighteenth meeting of the Informal Consultative Process on the Oceans and Law of the Sea, which centered around the timely topic of "The effects of climate change on oceans." The UNGA released resolution 72/73 on 5 December 2017, which noted the urgent need to address the environmental, social and economic impacts of the effects of climate on the oceans on all States, in particular developing States. Owing to the interconnected nature of the oceans, ensuing impacts cannot be overcome by any single State, particularly in view of the grave implications for countries with low-lying coasts, some of whose very existence is under threat.[72] In this regard, the UNGA recognized the need for international cooperation and coordination, including concerted and immediate action to combat these effects, as well as the need for continued coordinated international focus.

The Informal Consultative Process included discussions on ocean acidification, which has amounted so far to a 30% increase in the acidity of ocean surface waters since the beginning of the industrial era. The UNGA noted with concern the findings of the Intergovernmental Panel on Climate Change (IPCC) and World Meteorological Organization (WMO) on ocean acidification and expressed appreciation for their further work, including the decision of the IPCC to prepare a special report on climate change and oceans and the cryosphere and the decision of the WMO to foster collaboration with organizations and institutions that address the carbon budget of the ocean. It also urged enhancement of local, national, regional and global cooperation in this regard, including through the sharing of relevant information and the development of worldwide capacity to measure ocean acidification, and to take steps to make marine ecosystems healthier and, as a result, more resilient, to the extent possible, to the impacts of ocean acidification.[73] The resolution encouraged States and competent international organizations and other relevant institutions, individually and in cooperation, to urgently pursue further research on ocean acidification, especially through programmes of observation and measurement, and to increase national, regional and global efforts to address the negative impact of such acidity on vulnerable marine ecosystems, particularly coral reefs.[74]

Further, the UNGA encouraged States, individually or in collaboration with relevant international organizations and bodies, to enhance their scientific activity to better understand the effects of climate change on the marine environment and marine biodiversity. [75] It noted the vital role that coastal blue carbon ecosystems, including mangroves, tidal marshes and seagrasses, play in climate adaptation and mitigation through carbon sequestration, and in increasing the resilience of coastal ecosystems to ocean acidification. It also noted the range of other benefits that these ecosystems provide, including sustainable livelihoods, food security and biodiversity conservation, and coastal protection, and encouraged States and relevant international institutions and organizations to work collaboratively to protect and restore coastal blue carbon ecosystems.[76]

The UNGA also welcomed the Paris Agreement, as well as its entry into force in November 2016. It encouraged all its parties to fully implement the Agreement and parties to the United Nations Framework Convention on Climate Change (UNFCCC) that have not yet done so to deposit their instruments of ratification, acceptance, approval or accession, as appropriate, as soon as possible. The resolution recognized the importance of raising awareness of the adverse impact of climate change on the marine environment, marine biodiversity and sea level.[77]

The UNGA also adopted resolution 72/72 on sustainable fisheries on 5 December 2017, which urged States to intensify efforts to assess and address, as appropriate, the impacts of global climate change and ocean acidification on the sustainability of fish stocks and the habitats that support them, in particular the most affected ones.[78] It further called upon States and regional fisheries management organizations and arrangements to consider the potential adverse impacts of climate change on fish stocks when establishing conservation and management measures and identifying options to reduce risks and adverse impacts with respect to fisheries management and the health and resilience of marine ecosystems.[79] In total, the two resolutions represented a comprehensive acknowledgement of the widespread potential for adverse impacts of climate change on the oceans and the human communities that depend on their health. They came at the end of a year with a great deal of international recognition for the threats that oceans face.

On 4-17 September 2018 at United Nations Headquarter in New York City, the 1st Session of the Intergovernmental Conference (IGC) on an International Legally Binding Instrument (ILBI) took place under the United Nations Convention on the Law of the Sea (UNCLOS) on the Conservation and Sustainable Use of Marine Biological Diversity of Areas Beyond National Jurisdiction (BBNJ).[80] IGC President Rena Lee of Singapore stated

71 Information in this section was kindly provided by Valentina Germani, UN Division of Ocean Affairs and the Law of the Sea
72 A/RES/72/73. Paragraph 189.
73 A/RES/72/73. Paragraph 194.
74 A/RES/72/73. Paragraph 190-191.
75 A/RES/72/73. Paragraph 196.
76 A/RES/72/73. Paragraph 197.
77 A/RES/72/73. Paragraph 198.
78 A/RES/72/72. Paragraph 10.
79 A/RES/72/72. Paragraph 12.
80 IISD Earth Negotiations Bulletin. 2018. "Summary of the 1st Session of the Intergovernmental Conference on an International Legally Binding Instrument under the United Nations Convention on the Law of the Sea

that progress was made during IGC-1 on options for funding; potential procedures for area-based management tools (ABMTs) and marine protected areas (MPAs); options for environmental impact assessments (EIAs); and approaches for access and benefit-sharing around marine genetic resources.

Several delegates shared interventions that mentioned the impacts of climate change on the oceans, and the need to consider them in the process of creating a new ILBI on BBNJ. This topic came up most often during discussions on ABMTs, where delegates from Costa Rica and Chile noted the usefulness of a global integrated MPA network in improving resilience to the impacts of climate change. There was some debate in the discussions of EIAs, where some delegates disagreed over whether or not to include cumulative impacts on ecosystems including climate change and ocean acidification. This issue remained unresolved and will be discussed when the second IGC convenes from 25 March – 5 April 2019.

Our Oceans Conference (29-30 October 2018, Bali, Indonesia)

The Our Oceans Conference is held annually and rotates hosts amount different national governments with the purpose of generating actions and financial commitments to maintain the sustainability of ocean ecosystems and resources, and to enhance international collaboration around meeting those commitments. The fifth Our Oceans Conference was hosted by the Government of the Republic of Indonesia in Bali on 29-30 October 2018. In total, Our Oceans Conferences have attracted commitments totaling about 18 billion USD from governments, private businesses, NGOs, and research institutes and prompted the creation of 12.4 million square kilometers of new marine protected areas.

Nearly 50 commitments in the "climate change" theme were created or renewed at the Bali Our Oceans Conference. The European Union committed 5 million EUR to design new ocean forecasting models, including through further development of the EU satellite monitoring program. The host country, Indonesia, made several significant pledges, including a commitment to rehabilitate nearly 2 million hectares of mangroves over 5 years. Several other governments, including the United States, Germany, Ireland, the United Kingdom, Mauritius, and Peru joined 17 NGOs and academic institutions in making the remaining commitments. More detail on some commitments that apply to other sub-topics in this report are detailed in the appropriate sections.

on the Conservation and Sustainable Use of Marine Biological Diversity of Areas Beyond National Jurisdiction: 4-17 September 2017." NYC: IISD, 2018. http://enb.iisd.org/download/pdf/enb25179e.pdf

3. THE CENTRAL ROLE OF NATIONALLY DETERMINED CONTRIBUTIONS

Nationally Determined Contributions (NDCs) are plans prepared by each signatory of the Paris Agreement that outline their post-2020 climate actions in mitigation and adaptation.[81] The NDC format is markedly different than previous UNFCCC processes because emissions reductions pledges are not limited to Annex I nations, and national mitigation goals are self-set rather than negotiated collectively.[82]

NDCs are valuable windows into the priorities and interests of national governments. They are a resource to take the pulse of a national government's ambition in mitigation actions and its most pressing adaptation concerns. Therefore, they provide an excellent opportunity to look for a national government's inclusion of the climate's interface with and impacts on oceans and coasts. Of course, NDCs are not the only indication of a government's investment in ocean and climate issues; many governments which do not address oceans in their NDCs are very active in international ocean and climate policy spheres.

An initial analysis by Gallo et al. published in October 2017 took stock of how national governments are including marine issues in NDCs.[83] This analysis is discussed in detail in the *Progress Report: 2016-2017*.[84] The authors developed a Marine Focus Factor (MFF) to quantify the quality of an NDC's inclusion of ocean issues. Factors associated with a higher MFF included longer coastlines, status as a non-Annex I country under the UNFCCC, and classification as a Small Island Developing State (SIDS). In total, 70% of all NDCs include mention of ocean and coastal issues. Common topics for NDCs with the highest MFFs included ocean warming, coastal vegetated ecosystems (in terms of blue carbon storage or coastal protection), sea level rise, coral reefs, ocean acidification, fisheries, and tourism.

For the UNFCCC, 2018 was the year of the Talanoa Dialogue. The "facilitative dialogue," called "Talanoa" in

81 FCCC/CP/2015/L.9/Rev.1. Article 4, Paragraph 2

82 "Annex I Parties include the industrialized countries that were members of the Organization for Economic Cooperation and Development (OECD) in 1992, plus countries with economies in transition (EIT), including the Russian Federation, the Baltic States, several Central and Eastern European States." For more information on UNFCCC groupings: http://unfccc.int/parties_and_observers/items/2704.php

83 Gallo, N.D., Victor, D.G. and L.A. Levin. 2017. Ocean commitments under the Paris Agreement. Nature Climate Change 7(11):nclimate3422.

84 Kurz, M.L., Cicin-Sain, B., Bahri, T., Balgos, M., Herr, D., Journeay-Kaler, P., Levin, L., Sunami, A., Maekawa, M., Turley, C., Vallette, P., Vierros, M., Virdin, J., and Weber, A. Assessing Progress on Ocean and Climate Action: 2016-2017. Washington, D.C.: Global Ocean Forum, 2017. https://rocainitiative.files.wordpress.com/2017/11/roca-progress-report-email-november-41.pdf

reference to the Fijian concept of inclusive, empathetic, and open discussion, takes stock of the Parties' efforts to meet the goals of the Paris Agreement thus far and informs the revision of future iterations of the NDCs. The Talanoa Dialogue began in January 2018 with the submission of Party and non-Party stakeholder inputs, which are defined by three overarching questions: 1) "Where are we?" 2) "Where do we want to go?" and 3) "How do we get there?"

The UNFCCC Secretariat prepared a summary of the 220 inputs to inform the May 2018 sessions of the UNFCCC subsidiary bodies, which included seven Talanoa Dialogue groups.[85] There was a broad theme in the inputs calling for accelerated action at all levels of mitigation and adaptation among both Parties and non-Party stakeholders, pointing to the substantial gap between projected warming based on the current NDCs and the goals of keeping warming below 2 or 1.5°C. A handful of inputs drew attention to specific ocean issues, such as ocean acidification and marine biodiversity losses. Ocean-based mitigation such as the preservation of blue carbon ecosystems also make the occasional appearance. The summary highlights the notable efforts to highlight action on the ground in ocean and coastal issues, which represented a little less than 10% of inputs that highlighted existing initiatives.

The Presidencies of COP23 and COP24, Fiji and Poland respectively, released a summary of the in-person Dialogue conducted at the May sessions.[86] The discussions focused strongly on the IPCC Special Report on Warming of 1.5°C, and the summary's only mention of oceans and coasts is to acknowledge the pressing threat of sea level rise along the world's coastlines and particularly for SIDS. At minimum, this indicates that participants in the Dialogue are acknowledging the urgency of ambitious mitigation action to protect coastal and island communities.

The Dialogue will end with the political process at COP24 on 6 December 2018. The final product will be a document which synthesizes the Dialogues' reflections on the three key questions. Ultimately, this process will inform the next revision of NDCs, which is due to be completed by COP26 in 2020. Increased inclusion of ocean and coastal issues in this iteration can be a key quantitative way to measure progress in the awareness of ocean issues in the climate policy sphere. Involvement of the ocean and climate community in the process of updating NDCs will help promote the inclusion of ocean issues in the UNFCCC process and in national-level climate policies, and the ocean and climate policy community should consider this a priority area of engagement.

In the second *Because the Ocean*[87] declaration launched at COP22 in Marrakesh the 38 governments signatory agreed that "*Because the Ocean* is taking an increasingly central place in the global policy arena, we are encouraging UNFCCC Parties to consider submitting Nationally Determined Contributions that promote, as appropriate, ambitious climate action in order to minimize the adverse effects of climate change in the ocean and to contribute to its protection and conservation". Since then, several workshops on the incorporation of the ocean in NDCs have been organized under the aegis of the *Because the Ocean* initiative, and more are scheduled to take place in 2019.

85 "Overview of Inputs to the Talanoa Dialogue." Bonn: UNFCCC, 2018. https://unfccc.int/sites/default/files/resource/Overview%20of%20inputs%20to%20the%20Talanoa%20Dialogue.pdf

86 "Summary of the Talanoa Dialogue at the May Sessions." Bonn: UNFCCC, 2018. https://img1.wsimg.com/blobby/go/9fc76f74-a749-4eec-9a06-5907e013dbc9/downloads/1cgc07t0q_77988.pdf

87 www.BecauseTheOcean.org

4. MITIGATION

Roadmap Recommendation: 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 Blue Carbon" Science and Policies

Sustainably conserve and enhance coastal ecosystems as major carbon sinks and integrate the management of the coastal carbon ecostemes ("Blue Carbon") into the policy and financing processes of the UNFCCC, and account for these ecosystems in the national reports to the UNFCCC and the NDCs (Nationally Determined Contributions)

In broad terms, blue carbon refers to carbon stored, sequestered and cycled through coastal and ocean ecosystems. However, with regard to climate mitigation, coastal blue carbon (also known as "coastal wetland blue carbon"[88]) is defined as the carbon stored in mangroves, tidal salt marshes, and seagrass meadows within the soil, the living biomass above ground (leaves, branches, stems), the living biomass below ground (roots and rhizomes), and the non-living biomass (litter and dead wood[89]). When protected or restored, coastal blue carbon ecosystems act as carbon sinks (Figure 2).They are found on every continent except Antarctica and cover approximately 49 Mha.

Currently, for a blue carbon ecosystem to be recognized for its climate mitigation value within international and national policy frameworks it is required to meet the following criteria:

1) Quantity of carbon removed and stored or prevention of emissions of carbon by the ecosystem is of sufficient scales to influence climate;
2) Major stocks and flows of greenhouse gases can be quantified;
3) Evidence exists of anthropogenic drivers impacting carbon storage or emissions.
4) Management of the ecosystem that results in increased or maintained sequestration or emissions reductions is possible and practicable; and
5) Management of the ecosystem is possible without causing social or environmental harm

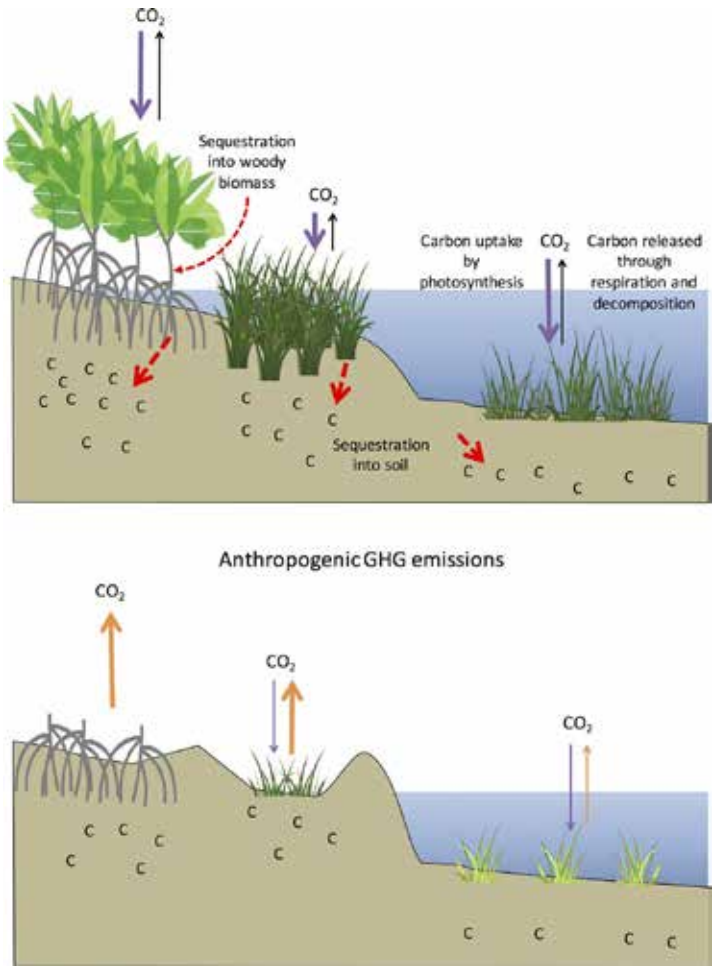


Figure 3. (a) In intact coastal wetlands (from left to right: mangroves, tidal marshes, and seagrasses), carbon is taken up via photosynthesis (purple arrows) where it gets sequestered long term into woody biomass and soil (red dashed arrows) or respired (black arrows). (b) When soil is drained from degraded coastal wetlands, the carbon stored in the soils is consumed by microorganisms, which respire and release CO2 as a metabolic waste product. This happens at an increased rate when the soils are drained (when oxygen is more available), which leads to greater CO2 emissions. The degradation, drainage, and conversion of coastal blue carbon ecosystems from human activity (i.e.. deforestation and drainage, impounded wetlands for agriculture, dredging) results in a reduction in CO2 uptake due to the loss of vegetation (purple arrows) and the release of globally important GHG emissions (orange arrows).

88 Howard, J., Hoyt, S., Isensee, K., Telszewski, M., Pidgeon, E. (eds.) (2014). Coastal Blue Carbon: Methods for assessing carbon stocks and emissions factors in mangroves, tidal salt marshes, and seagrasses. Conservation International, Intergovernmental Oceanographic Commission of UNESCO, International Union for Conservation of Nature. Arlington, Virginia, USA. 180 p.

89 Howard, J., Hoyt, S., Isensee, K., Telszewski, M., Pidgeon, E. (eds.) (2014). Coastal Blue Carbon: Methods for assessing carbon stocks and emissions factors in mangroves, tidal salt marshes, and seagrasses. Conservation International, Intergovernmental Oceanographic Commission of UNESCO, International Union for Conservation of Nature. Arlington, Virginia, USA. 180 p.

While countries are in the process of revising their NDCs for the next submission in 2020, many stakeholders are continuing to 1) provide guidance and support on how to include management activities related to coastal blue carbon ecosystems in the revised NDCs,[90] as well as 2) other tools and capacity building efforts to improve decision-making at the same time than management responses on the ground.

The Nature Conservancy (TNC), together with IUCN and the University of Cambridge released, for example, a new Mangrove Restoration Potential (MRP) Map.[91] The MRP Map is a unique interactive tool developed to explore potential mangrove restoration areas worldwide and model the potential benefits associated with such restoration. The MRP Map shows that restoration of lost mangroves worldwide could lead to the storage of an extra 69 million tonnes (0.069 gigatonnes) of carbon in aboveground biomass and would also help to avoid further emissions of some 0.296 gigatonnes of soil carbon. Such numbers convert to the equivalent of annual emissions from 25 million US homes in sequestration and 117 million homes in avoided emissions. Countries can use the Map to integrate, or strengthen the integration of, mangroves in NDCs, for ecosystem-based mitigation and adaptation.[92]

The Scientific Working Group of the Blue Carbon Initiative (co-facilitated by IUCN, CI and IOC-UNESCO) met in Weihai, China early September 2018. The meeting focused on blue carbon in the Asian-Pacific region, with the purpose of sharing the best practices and findings of blue carbon research and advancing bilateral and multilateral cooperation in the field of blue carbon science and policy.[93]

Capacity-building was further conducted with the support of the International Partnership for Blue Carbon (IBPC) and the leadership of Australia via the Pacific Workshop and Third Annual IPBC Meeting, Suva September 2018.[94] A key theme of both events was the value of coastal ecosystems to the Pacific region and the importance of improving the availability of data. There was also a continued discussion around access to finance to support blue carbon efforts.

In terms of financing, new initiatives like the Blue Natural Capital Financing Facility (BNCFF) have emerged to help create a pipeline of bankable investment opportunities for coastal resilience projects with clear ecosystem service benefits, including blue carbon.[95]

The Blue Carbon Primer is a new, comprehensive and current compendium of the state of the science, the state of maps and mapping protocols, and the state of policy incentives in the Blue Carbon concept, to be released at the UNFCCC COP 24.

4.2. Further Accelerate Progress in Addressing Air Emissions From Ships

The modern global economy is based on the movement of goods across national borders and expansive oceans. In order to maintain and grow the level of economic prosperity brought on by this trade and transport, the shipping industry has evolved to carry roughly 90% of global trade.[96] These benefits to the global economy come with a price, as the shipping industry currently accounts for roughly 2.2% of total carbon emissions.[97]

The IMO has committed to reducing annual GHG emissions by 50% by 2050, compared to 2008 levels, as well as to reaching peak emissions as soon as possible. Projections suggest that with no action, 2050 shipping emissions could increase by up to 300% from 2008 levels under high demand scenarios. The IMO plans to utilize technological and operational improvements to mitigate emissions growth caused by increased demand for shipping, as well as low and zero carbon fuel sources.

The International Maritime Organization (IMO), the UN agency responsible for maritime security and pollution mitigation, announced ambitious plans to reduce greenhouse gas emissions globally. Citing the Paris Agreement, the IMO's April 2018 meeting resulted in a commitment to reduce total annual GHG emissions by 50% by 2050, compared to 2008, in addition to reaching peak emissions as soon as possible.[98] Projections suggest that with no action, 2050 shipping emissions could increase by up to 300% from 2012 levels under high demand scenarios.[99] The IMO plans to utilize technological and operational improvements to mitigate emissions growth caused by increased demand for shipping, as well as low and zero carbon fuel sources. The IMO has maintained the goal of improving energy efficiency in new ships by 30% in 2025 compared to 2014, as well as operationalizing the mandatory Ship Fuel Oil Consump-

90 Seddon N., et al. 2018. Nature-based Solutions and the Nationally Determined Contributions: a synthesis and recommendations for scaling up ambition for nature. A report prepared by IUCN and Oxford University to support the Talanoa Dialogue and the Global Stocktake of the Paris Agreement. October 2018. Forthcoming.
91 maps.oceanwealth.org/mangrove-restoration
92 Information brief. How Mangrove Restoration Can Generate Local and Global Benefits. TNC, IUCN and Cambridge University.
93 http://thebluecarboninitiative.org/china2018/
94 http://bluecarbonpartnership.org/wp-content/uploads/2018/10/2018-IPBC-Meeting-and-Workshop-Summary-report.pdf
95 https://bluenaturalcapital.org/
96 http://www.ics-shipping.org/shipping-facts/shipping-and-world-trade
97 http://www.imo.org/en/OurWork/Environment/PollutionPrevention/AirPollution/Pages/Greenhouse-Gas-Studies-2014.aspx
98 Sub-Committee on Pollution Prevention and Response. (2018, March 23). REPORT TO THE MARINE ENVIRONMENT PROTECTION COMMITTEE (Rep.). Retrieved November 13, 2018, from International Maritime Organization website.
99 Directorate General for Internal Policies. November 2015. Emission Reduction Targets for International Aviation and Shipping.

tion Database reporting system to keep track of fuel efficiency progress.

The International Energy Agency (IEA), a global leader on energy issues, has advised the IMO on its ambitious goal of emissions reduction, recommending investments into retrofitting, transitioning to low and zero-carbon fuel sources, adopting enhanced efficiency standards, and optimizing trade operations and capacity utilization.[100]

With EU funding, the IMO's Global Maritime Technology Cooperation Center (MTCC) Network has rolled out pilot projects aimed at bringing developing economies from across the globe together to combat carbon emissions by pooling resources, sharing technologies and skills, and innovating ideas for greater emissions control.[101] The five regions (Asia, Africa, Latin America, Pacific, and the Caribbean) have held workshops focused on recording, sharing, and analyzing physical and electronic data that can be used as a baseline for future mitigation efforts.

The shipping industry, represented by the International Chamber of Shipping, has also taken considerable steps in reducing carbon emissions, primarily through research into alternative fuel sources.[102] Biofuels and liquid natural gas can serve as less carbon-intensive fuel sources, while research into battery technology, fuel cells, and nuclear energy could yield zero emissions down the road, although these methods are still in an early stage of development and implementation. Additionally, steps are being taken to achieve the IMO's goal of reducing the sulphur cap from 3.5% to 0.5% in 2020.

The commitments announced by the IMO will have significant influence on an industry that impacts all corners of the world. For these goals to be realized, the organization will have to work alongside national governments, private corporations, NGOs, academia, etc. On July 2, Transparency International issued a report calling into question the IMO's commitment to a fair and open process, claiming that private industry and certain member-states held disproportionate influence in decision-making processes and that many delegations lacked accountability to the public.[103] Transparency International has also been critical of a document rallying against an expansion of information access submitted by the US, the UK, the Cook Islands, Panama, the Marshall Islands, and the United Arab Emirates. While the debate remains ongoing, member-states like Australia, Liberia, and the Bahamas have shown a significant commitment to opening up the organization to outside groups.[104] Whether or not the IMO decides to incorporate a more open approach in the future may determine just how effective it will be in achieving its goals.

4.3 Sustainably Develop Ocean-based Renewable Energy

Sustainably develop ocean-based renewable energy (such as offshore wind power, wave energy, tidal power, and aquatic biofuels), and accelerate efforts to implement these approaches through integrated marine planning and enhanced regulatory frameworks

An essential step in moving away from fossil fuels involves the development of reliable renewable energy sources. To accomplish this transition, we must look past land-based fuel and consider the vast energy potential of water bodies around the globe. Traditional sources of offshore power include wind turbines and solar panels, although technological advances have opened the door to alternatives like wave and tidal motion. Significant work has been accomplished in the past year regarding offshore renewable energy in the form of conferences, projects, publications, and technologies.

From March 13-15, 2018. Oceanology International 2018 hosted a global audience in London to showcase marine-based technologies guiding the progress of ocean observation and survey systems.[105] From May 2-3, 2018. innovative technologies related to offshore wind, tidal, and wave energy were showcased in Glasgow at the All-Energy Exhibition and Conference 2018.[106] In Houston, industry, academia, government, and investors came together for the 2018 Algae Biomass Summit in October to address ways in which algae can be utilized as a fuel alternative, food source, and raw material in manufacturing.[107]

SwimSol GmbH has continued to build ocean-based solar infrastructure across the Maldives and Malaysia, with the hope of extending operations into other SIDS in the future.[108] Projections indicate that the largest growth in floating solar power generation will take place in Asia, with China leading the charge.[109]

The Renewable Energy Agency (IRENA) has continued its efforts specifically geared towards building energy independence across Small Island Developing States, surpassing its ambitious goal of developing 100 MW of

100 Schuitmaker, R., & Cazzola, P. (2018, April 13). Commentary: International Maritime Organization agrees to first long-term plan to curb emissions. *International Energy Agency*.
101 https://gmn.imo.org/wp-content/uploads/2018/10/GMN-Summary-report-ISSUE-3_-FINAL-1.pdf
102 http://www.ics-shipping.org/docs/default-source/key-issues-2018/developing-zero-co2-fuels.pdf?sfvrsn=0
103 https://www.transparency.org/whatwedo/publication/governance_international_maritime_organisation
104 https://www.documentcloud.org/documents/4569218-C-120-4-5-Council-Reform-Antigua-and-Barbuda-Aust.html
105 http://www.oceanologyinternational.com/
106 http://www.all-energy.co.uk/
107 https://advancedbiofuelsusa.info/dispatch-from-the-2018-algae-biomass-summit/
108 https://swimsol.com/
109 https://www.energiasmarketresearch.com/global-floating-solar-energy-market-outlook/

solar PV and 20 MW of wind power and raising USD 500 million. While the goal of the IRENA SIDS Lighthouses Program was initially set for completion in 2020, its early attainment means that new goals enshrined in the Lighthouse Initiative 2.0 can now "enable SIDS energy systems' transformation, leverage investment support, strengthen climate resilience, and contribute to the attainment of the sustainable development goals in SIDS."[110]

The Renewable Energy Agency has surpassed its goal of developing 100 megawatts of solar power and 20 megawatts of wind power across Small Island Developing States. The agency also raised USD 500 million, thereby completing its goal three years early.

IRENA has also focused more specifically on offshore renewable energy sources in developed states, issuing a brief geared towards G7 policymakers in September. This report serves to "confirm the rapid capacity growth, ongoing cost and performance improvements, increasing technological sophistication and continued need for international standardisation for new renewables, such as offshore wind power and nascent ocean energy technologies."[111] The report makes references to another IRENA report from April, in which the group lays out a plan for Global Energy Transformation by 2050.[112]

The Walney Extension Offshore Wind Farm, dubbed the world's largest operational offshore wind farm at a total capacity of 659 MW, opened in early September 2018 in the Irish Sea. The project will ideally be able to power about 600,000 homes in the UK. In India, plans for 5 GW of offshore wind by 2022 and 30 GW by 2030 have been announced by the Ministry of New and Renewable Energy.[113] In the US, the state of Massachusetts has passed legislation seeking to achieve 1600 MW of new offshore wind energy by 2027 and 3200 MW by 2035.[114] On November 9th, the state of New York officially launched its first Request for Proposals for offshore wind energy in the hopes of achieving its goal of 2400 MW by 2030.[115]

The Walney Extension Offshore Wind Farm opened in September 2018, becoming the world's largest operational wind farm at a total capacity of 659 megawatts. The project will ideally be able to power roughly 600,000 homes in the United Kingdom.

Offshore renewable energy exhibits significant promise as a means of efficiently reducing GHG emissions, especially if nations and organizations continue to build on their commitments. With advancements in technology, creative innovations, targeted investments, cooperation between parties, capacity development, and a sense of stewardship for the environment, offshore renewable energy can become a central component in the movement to a greener world.

4.4 Consider the Potential for Ocean-based Carbon Capture and Storage

Consider the potential for ocean-based carbon capture and storage, and, if appropriate, further develop regulatory systems for ocean-based sequestration and marine engineering

Ocean-based carbon capture and storage methods are still under review by the scientific community. The ocean naturally serves as a carbon sink, but carbon dioxide from the atmosphere enters the water it takes the form of carbonic acid. The resultant ongoing decrease in ocean pH is known as ocean acidification. Efforts to enhance the ocean's ability as a carbon sink must consider this phenomenon.

The authors of a 2018 assessment considered the readiness and efficacy of global- and local-scale ocean-based measures to reduce climate impacts on marine ecosystems.[116] Each action was ranked on its potential ability to moderate climate stressors such as ocean warming and acidification, their technological readiness, the lead time until they would become effective following implementation, disbenefits, duration of benefits, co-benefits, cost effectiveness, and governability. The one measure that stood on its own as the highest-ranking measure

110 https://www.irena.org/events/2018/Sep/SIDS-Lighthouses-Initiative
111 IRENA (2018), "Offshore innovation widens renewable energy options: Opportunities, challenges and the vital role of international co-operation to spur the global energy transformation" (Brief to G7 policy makers), International Renewable Energy Agency, Abu Dhabi.
112 IRENA (2018), Global Energy Transformation: A roadmap to 2050, International Renewable Energy Agency, Abu Dhabi.
113 http://pib.nic.in/PressReleseDetail.aspx?PRID=1535909
114 https://www.vineyardwind.com/the-project/
115 https://www.nyserda.ny.gov/All-Programs/Programs/Offshore-Wind/Offshore-Wind-Solicitations/Generators-and-Developers/2018-Solicitation
116 Gattuso J-P, Magnan AK, Bopp L, Cheung WWL, Duarte CM, Hinkel J, Mcleod E, Micheli F, Oschlies A, Williamson P, Billé R, Chalastani VI, Gates RD, Irisson J-O, Middelburg JJ, Pörtner H-O and Rau GH. (2018). Ocean Solutions to Address Climate Change and Its Effects on Marine Ecosystems. Front. Mar. Sci. 5:337. doi: 10.3389/fmars.2018.00337

for all dimensions and did not fit with the other clusters was the ambitious and immediate implementation of ocean-based renewable energy. The other measures were divided into three clusters.

The first cluster consisted of large-scale measures that are likely to be very effective at moderating warming and/or acidification, but require a great deal more research before their technological feasibility, cost effectiveness, and potential negative side effects are fully understood. This cluster included alkalinization on a global scale, hybrid methods (ex. growing and harvesting kelp for use as biofuel), albedo enhancement, and ocean-based cloud brightening. Alkalinization induces the natural or artificial neutralization of carbonic acid by causing it to react with added dissolved bicarbonate and carbonate ions, or precipitating it as calcium carbonate.[117] This process would be a highly effective and permanent counter to ocean acidification, however, the potential side effects of adding alkaline components to the ocean on a global scale are little known and it would be very expensive.[118] Albedo enhancement refers to the alteration of the dark ocean surface using long-lived ocean micro-bubbles or foams to enhance its reflectiveness of solar radiation.[119] It could be very effective in reducing the GHG-induced forcing on the global radiation balance, but would be temporary and would do nothing to address ocean acidification.

The second cluster encompassed measures that would be moderately effective at a small, local scale, are technologically ready, have few disbenefits, and mostly have significant co-benefits. This cluster included protection of coastal and marine ecosystems, reduction of general pollution to reduce stress, restoring coastal vegetative ecosystems at local scales, rebuilding coral and oyster reefs, reducing overexploitation of key species, and restoring natural hydrology of coastal ecosystems. These measures are all highly recommended for implementation at the regional and local scale as they moderate impacts on species, ecosystems, and human communities, but they are not silver bullets for the overarching global problems of warming and acidification. These measures are the most frequently discussed in NDCs and are discussed in detail as adaptation measures elsewhere in this report.[120] The third and final cluster consisted of

measures which are far from technologically readiness, likely to cause disbenefits and lack co-benefits, unlikely to be governable, and may not even be effective. These measures were assisted evolution of key species, alkalinization at a local scale, and iron fertilization.

Overall, little progress has been made in the 2017-2018 period. The 2018 analysis by Gattuso et al. discussed here underscores the importance of an ambitious renewable energy transition as the only method the global community knows will be highly effective and can feasibly implement in the required short time scales. Other mitigation technology is still out of reach and likely to cause negative side effects. This analysis also highlights the technological readiness and benefits of certain local- and regional-scale actions that can reduce negative impacts on ocean and coastal ecosystems and the communities with depend on them.

117 Renforth, P. and G. Henderson. (2017). Assessing ocean alkalinity for carbon sequestration. Rev. Gephys. 55:636-674. doi: 10.1002/2016RG000533.

118 Hartmann, J., West., J., Renforth, P., Kohler, P., De La Rocha, C.L., Wolf-Gladrow., D.A. et al. (2013). Enhance chemical weathering as a geoengineering strategy to reduce atmospheric carbon dioxide, a nutrient source and to mitigate ocean acidification. Rev. Geophys. 51: 113-149. doi: 10.1002/rog.20004.

119 Crook, J.A., Jackson, L.S., and Forster, P.M. (2016). Can increasing albedo of existing ship wakes reduce climate change? J. Geophys. Res. Atmos. 121: 1549-1558. doi: 10.1002/2015JD024201.

120 Gallo, N.D., Victor, D.G. and L.A. Levin. 2017. Ocean commitments under the Paris Agreement. Nature Climate Change 7(11):nclimate3422.

5. ADAPTATION

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 storminess 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, 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.

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

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…….Governments at all levels must develop clear policies for coastal protection, planning and damage response……to manage the world's coastlines as climate change continues to increase exposure to hazard and risk.

The year 2017 was one of the most devastating yet for highlighting the enormous effects that climate change is having on the world's coasts and the subsequent impacts upon the global population. 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 salt water intrusion. Scientists have been warning of the catastrophic impacts that climate change is having upon the world's oceans[121,122,123] and that these impacts are cumulative over

121 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.

122 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.

123 IPCC. (2014). Climate Change 2014: Synthesis Report. Fifth Assessment Report of the Intergovernmental Panel on Climate Change

time and will continue to increase in severity. The 2017 report on progress on ocean and climate action[124] presents a disturbing picture of the level of environmental deterioration in the global oceans due to climate change impacts. The inclusion of oceans in the UNFCCC Paris Agreement in 2015 was an important but long overdue decision, and even with that recognition it unfortunately seems to take disasters to actually get people to realise that significant change is happening as our atmosphere heats up. If earlier storms such as Hurricanes Katrina in 2005 and Sandy in 2012, and Typhoon Haiyan in 2013 were not warning enough, the well-publicised impacts of the 2017 hurricane season on the Caribbean islands and coastal cities and communities across the Gulf and Atlantic coasts of the United States have made it clear that the effects of climate change are becoming more and more obvious. There is no doubt that around the world we are seeing real and tangible impacts of climate change on a scale hitherto not experienced. 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.[125]

The year 2017 was one of the most devastating yet for highlighting the enormous effects that climate change is having on the world's coasts and the subsequent impacts upon the global population……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.

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, and 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 emphasises that many of the most vulnerable at present are Native American communities.[126] This report even provides a guidebook for coastal communities that are looking to relocate. Another 2017 study by the Union of Concerned Scientists states that "[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." [127]

As if to make a point, the 2018 hurricane season ended with a series of deadly storms, including the intense storms Florence and Michael, that wreaked havoc across the Gulf and southeastern Atlantic seaboard of the United States. What was so devastating about these storms was their intensity and that, like Hurricane Harvey in 2017, it was not only damage by waves and storm surge that resulted, but catastrophic and widespread damage from rain-induced flooding and extraordinarily powerful winds. Furthermore, 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 alarming increases in fatalities as previously maritime coastal regions become more arid.

Of course, none of this compares with the catastrophic impacts being faced by low-lying small island developing states (SIDS) that are facing the prospect of complete submergence and in some cases the necessity of evac-

[Core Writing Team, R.K. Pachauri and L.A. Meyer (eds.)]. IPCC, Geneva, Switzerland, 151 p.

124 Kurz, M. and B. Cicin-Sain. (2017). Assessing Progress on Ocean and Climate Action: 2016-2017, A Report of the Roadmap to Oceans and Climate Action (ROCA) Initiative, 29p. (https://rocainitiative.files.wordpress.com/2017/11/roca-progress-report-email-november-41.pdf)

125 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.

126 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.

127 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.

uating their entire population to another country. It is predicted that for the world's 52 small island states, sea-level rise is as much as four times the global average and increasing levels of vulnerability means trillions

…..in the United States alone 13 million people will be at risk of potential displacement, and communities in such locations as Georgia, Louisiana, and Alaska are all in the process of looking for safer locations for their communities

of dollars in annual economic losses.[128] 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 truly alarming. It includes iconic destinations like the Maldives, the Seychelles, French Polynesia, the Solomon Islands, and New Caledonia. Kiribati has already taken the precaution of purchasing 6,000 acres of land in Fiji as a place 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.

Low-lying small island developing states (SIDS) are facing the prospect of complete submergence and in some cases the necessity of evacuating their entire population to another country. It is predicted that for the world's 52 small island states, 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.

So, 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. In Canada's Nova Scotia, for example, the provincial government has recognised the need to bring in stronger legislation for the protection of coasts and stricter management controls on infrastructure development in order to reduce risks associated with sea-level rise, increased storminess, and greater exposure to erosion and flooding. This new legislation will ensure that nature-based shoreline decision making is an essential element of the management of 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-gaps 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 a necessity as the impacts of climate change become more dangerous and uncontrollable.

The IPCC report on the implications of a 1.5°C increase in global warming 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 effectiveness of adaptation options comprising structural, physical, institutional, and social responses will depend largely on governance, political will, adaptive capacities, and the availability of finance.

The 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 latest IPCC report on the implications of a 1.5° C increase in global warming129 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, and demonstrates clear evidence that we are already experiencing the impacts of a 1°C increase and that substantial impacts are being felt in every region of the planet. The effectiveness of adaptation options comprising structural, physical, institutional, and social responses will depend largely on governance, political will, adaptive capacities, and the availability of finance. The report also reaffirms the importance of linking adaptation to sustainable development, and that transformational adaptation requires an integrated approach rather than addressing current vulnerabilities as stand-alone climate problems.

128 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)

129 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.

Carry out adaptation measures through the integrated coastal and ocean management institutions created at national and local levels in all regions of the world since the 1992 Earth Summit, in close cooperation with disaster risk agencies and affected sectors and communities

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 $1.5 billion in grant resources to date.[130]

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 Least Developed Countries Fund and the Special Climate Change Fund and Operational Improvements July 2018 to June 2022.[131] 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.[132]

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.[133]

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.[134] 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 Least Developed Countries (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 NDC 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.[135]

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.[136]

Apply ecosystem-based approaches to adaptation, especially regarding green infrastructure to provide natural system protection for defense against sea level rise, saltwater intrusion, storms, and flooding

Even under a climate stabilisation scenario of 1.5°C, adaptation to sea-level rise remains essential in coastal areas.[137] Coastal adaptation to restore natural ecosystems

130 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

131 Ibid.

132 Ibid.

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

134 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

135 Ibid.

136 Ibid.

137 Nicholls, R.J. *et al.* (2018) Stabilisation of global tem-

(such as rebuilding coastal dunes, planting mangrove forests, restoring estuarine wetlands) support SDGs for enhancing life and livelihoods on land and oceans. The report supports the adoption of ecosystem-based adaptation (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 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 $20.5 million Green Climate Fund (GCF) grant and $5 million from the Government of the Gambia, the "Large-scale Ecosystem-based Adaptation Project in The Gambia" (EbA) is using large-scale EBA, which is considered as 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.[138]

These measures are typically more supportive of SDGs especially when they are combined with participatory decision-making processes that promote equity and sustainability. Again, the report urges the inclusion of indigenous and local knowledge, and to make sure 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 study has 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.[139,140] A recent paper by Gattuso *et al.*[141] 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.

Establish and effectively manage coherent networks of marine protected areas in national and international waters to protect marine biodiversity and to enhance resilience of marine ecosystems to climate change, achieving the Convention on Biological Diversity's Aichi Biodiversity Target of conserving at least 10% of marine and coastal areas by 2020

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.[142] 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."[143]

The needed 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.[144]

perature at 1.5°C and 2.0°C: implications for coastal areas, *Philosophical Transactions A*, 376 (2119).

138 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

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

140 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

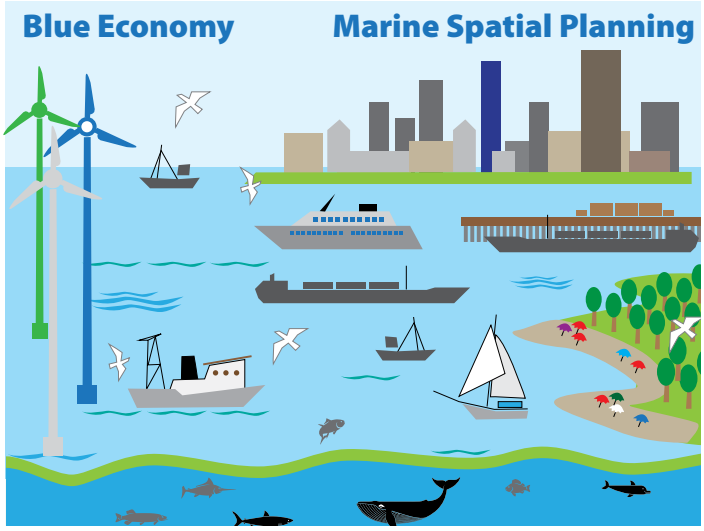
141 Gatusso et al. (2018) Ocean solutions to address climate change and its effects on marine ecosystems, Frontiers in Marine Science, 04 October 2018, https://www.frontiersin.org/articles/10.3389/fmars.2018.00337/full.

142 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

143 Ibid.

144 Ibid.

6. Blue Economy



When the Blue Economy concept was first introduced around the time of the Rio+20 Conference in 2012, most parties had varying definitions of what the term entailed. Some believed that it described all economic activities related to marine environments, regardless of their sustainability. More recently, however, the concept of the Blue Economy has been reinforced as the confluence of maintaining the integrity and health of the ocean system and those affected by it, while also developing economic opportunities that serve to reduce poverty and promote growth. More specifically, the definition of a Blue Economy is becoming increasingly based on a low-carbon foundation, meaning that industries like oil and gas are generally not included.

The first global Sustainable Blue Economy Conference, organized by the Government of Kenya in November 2018, has declared that a blue economy is one that necessarily involves a commitment to sustainability and conservation.[145] The conference, held in Nairobi, Kenya from November 26-28, 2018 included over 18,000 participants from 184 countries, and focused on 9 themes: smart shipping, ports, transportation, and global connectivity; employment, job creation, and poverty eradication; cities, tourism, resilient coasts, and infrastructure; sustainable energy, mineral resources, and innovative industries; ending hunger, securing food supplies and promoting good health and sustainable fisheries; management and sustaining of marine life, conservation and sustainable economic activities; climate action, agriculture, waste management, and pollution-free oceans; maritime security, safety, and regulatory enforcement; and people, culture, communities, and societies. This conference, along with other conferences centered around the blue economy, is geared towards achieving the 2030 Agenda for Sustainable Development laid out by the UN, specifically SDG14.

The June 2018 Our Ocean Conference in Bali, Indonesia, resulted in 48 tangible and measurable commitments specifically regarding the blue economy. Around 257 other commitments target maritime security, climate change, marine protected areas, marine pollution, and sustainable fisheries, bringing the total monetary commitment to roughly USD 10.7 billion.[146] Among other commitments, the European Union has maintained its EUR 250 million investment into an All-Atlantic Ocean Research Alliance that seeks to support over 1000 Atlantic research teams from the Arctic to the Antarctic by 2020. The program will support research into assessing ecosystems, seafloor mapping, and developing innovative ecosystem-based aquaculture systems. The EU also announced EUR 18 million invested towards developing a sustainable Blue Economy in the EU, with funds going towards skill development, demonstration projects, and "Blue Labs" that will focus on innovating sustainable products and services relevant to the marine field. Additionally, the EU has pledged a combined EUR 8 million in its partnership with 18 African countries and the African Union towards the satellite monitoring program Copernicus. Significant commitments were also made by the governments of Indonesia, Japan, Norway, Ireland, Mauritius, Portugal, Chile, and the United States.

The first global Sustainable Blue Economy Conference, organized by the Government of Kenya in November 2018, and involving 18,000 participants from 184 countries, has declared that blue economy is one that necessarily involves a commitment to sustainability and conservation

The 2018 Our Ocean Conference in Indonesia inalso yielded considerable commitments from NGOs, UN entities, academia, and the corporate sector. Most notably, the World Bank has committed more than USD 1 billion to advance the sustainable oceans and Blue Economy agenda in developing countries. Building on their previous work in developing the blue economy, the World Bank announced its PROBLUE initiative in September. This Multi-Donor Trust Fund (MDTF) focuses on 4 key themes: management of fisheries and aquaculture, reducing marine pollution, sustainable development of oceanic sectors like tourism and offshore renewable energy, and building government capacity for managing marine and coastal resources. The World Bank has already designated about USD 4 billion towards the blue economy, not including the USD 1 billion noted above. So far, the PROBLUE fund has raised roughly USD 100 million from donors like Norway, Canada, Iceland, Germany, Sweden, Portugal, Denmark, France, and the EU.

145 http://www.blueeconomyconference.go.ke/

146 https://ourocean2018.org/?l=our-ocean-commitments

The 2018 Our Ocean Conference further resulted in the Ocean Policy Research Institute (OPRI) of the Sasakawa Peace Foundation pledging USD 25 million in research funding, in addition to releasing a publication detailing the success factors to promote blue economy and achieve SDG14 using analyses of cases in Japan and overseas.[147] PepsiCo has set aside USD 15 million towards water infrastructure in South/Southeast Asia. Tidal BV plans to invest USD 225 million in a bridge connecting Flores and Adonara Islands in Indonesia, coupled with a tidal power station that is projected to save 47,500 MT carbon annually. REV Ocean, Norway has pledged USD 400-500 million to build the world's largest and most advanced research and expedition vessel.

The World Bank committed more than USD 1 billion to advance the sustainable oceans and Blue Economy agenda at the Our Ocean Conference in Indonesia

The conference on Financing Sustainable and Climate-Resilient Ocean Economy was hosted by the Seychelles in partnership with the World Bank from February 22-23. The Seychelles announced the completion of the first stage of its ambitious Marine Spatial Plan, while also pledging to create two new expansive Marine Protected Areas, both using an innovative funding technique involving a debt swap with groups like the Nature Conservancy.[148] The 10th Annual Blue Tech Week, held in San Diego from November 5-9, focused on technological innovations targeting sustainability and efficient use of marine resources that can bring the marine economy into a new age.[149] The Workshop on Arctic Governance, hosted in Tokyo from February 8-9 by the Sasakawa Peace Foundation, brought together leaders from the Arctic nations, as well as the EU, China, Japan, Singapore, and India, to discuss the future of the Arctic from the perspectives of conservation, use, and sustainable development of the region.[150]

147 Ocean Policy Research Institute. 2018. "Strategies for Promoting Blue Economy: Innovation and partnership development - Empirical lessons and future perspectives".
148 https://www.nature.org/en-us/about-us/where-we-work/africa/stories-in-africa/seychelles-conservation-commitment-comes-to-life/
149 https://www.bluetechweek.org/
150 https://www.spf.org/en/topri/news/workshop_on_arctic_governance_in_tokyo_2018.html

From March 7-9, 2018, the Economist hosted the fifth World Ocean Summit in Cancun-Playa del Carmen, Mexico, bringing together political leaders and policy-makers, industry heads, scientists, and NGOs to find and discuss the ideas most likely to achieve the transition to a sustainable ocean economy.[151] Held every three years, the 2018 East Asian Seas Conference in Iloilo, the Philippines, concluded on November 28th, demonstrating a strong focus on building the blue economy through growing partnerships, investments, and technologies.[152]

Concurrent with global conferences, many organizations have released important publications that detail the current situation of the blue economy, as well as advise on next steps. A prime example of this can be seen in the Institute of Renewable Energy's (IRENA) May 2018 report, "Corporate Sourcing of Renewables: Market and Industry Trends."[153] This document highlights the increased emphasis corporations place on renewable energy sources due to decreasing costs and growing public support. On May 31st, the Caribbean Development Bank and the UN Development Programme jointly published *Financing the Blue Economy: A Caribbean Development Opportunity*.[154] The detailed report discusses innovative financing techniques in the context of the Caribbean region with recommendations and advisories regarding the optimal path into the future. A January report from the Nicholas Institute for Environmental Policy Solutions and the Environmental Defense Fund delved into the topic of fisheries finance, laying out the necessary steps for achieving a sustainable fishing industry using blended capital approaches.[155]

151 https://events.economist.com/events-conferences/americas/world-ocean-summit/?utm_source=eloqua&utm_medium=iedm&utm_campaign=edm1
152 http://eascongress2018.pemsea.org/eas-congress-2018/official-programme/
153 IRENA (2018), Corporate Sourcing of Renewables: Market and Industry Trends – REmade Index 2018. International Renewable Energy Agency, Abu Dhabi
https://www.irena.org/publications/2018/May/Corporate-Sourcing-of-Renewable-Energy
154 Caribbean Development Bank. 2018. Financing the Blue Economy: A Caribbean Development Opportunity. http://issuu.com/caribank/docs/financing_the_blue_economy-_a_carib?e=21431045/61831833
155 Environmental Defense Fund and Nicholas Institute for Environmental Policy Solutions at Duke University. 2018. Financing fisheries reform: Blended capital approaches in support of sustainable wild-capture fisheries. Available at: edf.org/blendedcap

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 climate-induced refugees and migrants, including the development and implementation of appropriate financing measures.

Session 7 of Oceans Action Day at COP 23 addressed Migration and Displacement: Risk Reduction and Preparedness.[156] Panelists spoke of the urgent need to address gaps in international law, the respect and recognition of cultural and spiritual rights, and the overarching need for displacement and migration to be conducted with dignity, as they are an option of last resort. There is an urgent need for an international policy framework at the United Nations, as well as in the UNFCCC process, to clarify issues related to human displacement as a result of climate change. 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 Migrants (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.[157] This report estimated that 18.8 million people in 135 countries were displaced due to environmental disasters in 2018. The majority of these movements occurred primarily within national borders, but some groups are forced to cross borders.

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 discerning whether displacement due to individual events should be covered under climate change displacement mechanisms will be extremely difficult. Slow-onset events like salt-water 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.

18.8 million people in 135 countries were displaced due to environmental disasters in 2018.

Definitional issues will have to be further discussed and agreed upon as climate-induced displacement becomes more frequent and involves 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.[158] 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. A certain amount of climate-induced displacement is now considered unavoidable, and resilience development through disaster risk reduction is becoming highly relevant for displaced persons. The conventional wisdom suggests that mitigation, preemptive disaster risk reduction, and adaptation can avoid and reduce human suffering and long-term costs of displacement.

New research led by the Red Cross Red Crescent Cli-

156 Oceans Action Day at COP 23 Summary: https://rocainitiative.files.wordpress.com/2018/02/oceans-action-day-at-cop-23-summary.pdf

157 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

158 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

mate 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.[159] 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.

A certain level of climate-induced displacement is now considered unavoidable, and resilience development through disaster risk reduction is becoming highly relevant for displaced persons.

The 20 year anniversary of the Internal Displacement Monitoring Centre marked the release of the comprehensive Global Report on Internal Displacement 2018,[160] citing that 61% 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 inter-governmental organization of the UN system, acts with its partners in the international community to assist in meeting the operational challenges of migration. To combat the growing problem of environmentally induced displacement, the IOM released the *IOM Pacific Strategy: 2017-2020* in 2017. This report is discussed in detail in the 2016-2017 ROCA Progress Report. The IOM has continued to work toward the outcomes under the regional strategy put forward in the Pacific Strategy in 2018. 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,*[161] which is focused on longer-term contribution to fostering a better and more balanced understanding of migrants and migration. The 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.[162]

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.[163]

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.[164] 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.[165]

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."[166]

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.[167] UN Member States agreed to

159 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

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

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

162 http://sdg.iisd.org/news/iom-provides-guidance-on-integrating-migration-into-sdg-planning/

163 https://www.unisdr.org/we/inform/events?rid=2&timeID=2018&tid=0&hid=0&x=17&y=9

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

165 https://www.unisdr.org/archive/60875

166 https://www.un.org/pga/72/2018/09/05/towards-a-global-pact-for-the-environment/

167 https://refugeesmigrants.un.org/intergovernmental-confer-

cooperate on the elaboration of a Global Compact for Safe, Orderly and Regular Migration (GCM) and a Global Compact on Refugees (GCR). The GCM is expected to be adopted at an Intergovernmental Conference to Adopt the Global Compact for Safe, Orderly and Regular Migration to be held on December 10 and 11, 2018 in Morocco.[168] 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.

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.

In October 2018, the United Nations Office for Disaster Risk published a report[169] 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 a whopping $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.

ence-2018
168 ibid
169 https://www.preventionweb.net/publications/view/61119

A report released from the World Bank Group, *Groundswell: Preparing for Internal Climate Migration*[170] 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.[171] Additionally, Bangladesh became the new Chair of the PDD, taking over for Germany.[172]

The PDD has facilitated extensive interactions with 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

170 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.
171 https://disasterdisplacement.org/wp-content/uploads/2015/02/15012017-PDD-Workplan.pdf
172 https://disasterdisplacement.org/bangladesh-becomes-the-new-chair-of-the-platform-on-disaster-displacement

of disaster displacement data.[173] 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. [174]

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.[175] 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 challenges associated with disaster displacement.[176] 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.

Climate impacts could displace as many as 140 million people within their own borders by 2050.

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.[177] 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,*[178] 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 working closely with UN humanitarian efforts, has ramped up its actions inthe 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.[179] They produced a report on *Housing, Land and Property Rights and Peace Agreements: Guidance for the Myanmar Peace Process*,[180] 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*.[181] 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.[182] 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,*[183] 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.

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 P-SIDS, who have taken on a leadership role in the recent UNFCCC processes, through the Presidency of Fiji hosting COP 23 to the implementation of the Talanoa Dialogue.

The Warsaw International Mechanism (WIM) for Loss

173 https://disasterdisplacement.org/together-at-the-humanitarian-network-and-partnerships-week
174 https://disasterdisplacement.org/pacific-region-discusses-links-between-human-mobility-environment-and-climate-change
175 https://disasterdisplacement.org/addressing-the-needs-of-persons-moving-in-the-context-of-disasters-and-climate-change-in-the-global-compact-for-migration
176 https://disasterdisplacement.org/2018-amcdrr-side-event-addressing-human-mobility-and-displacement-in-natioanl-drr-strategies
177 https://www.climatecentre.org
178 https://media.ifrc.org/ifrc/world-disaster-report-2018/
179 https://www.openglobalrights.org/climate-land-banks-addressing-displacement-in-myanmar-and-beyond/
180 http://displacementsolutions.org/wp-content/uploads/2018/03/HLP-Rights-and-Peace-Agreements-Guidance-for-Peace-Negotiators-in-Myanmar-1.pdf
181 http://displacementsolutions.org/wp-content/uploads/2018/06/An-Overview-of-DS-work-on-HLP-Rights-in-Myanmar-2009-2018-1.pdf
182 https://www.openglobalrights.org/climate-land-banks-addressing-displacement-in-myanmar-and-beyond/
183 http://displacementsolutions.org/wp-content/uploads/2018/06/Torres-Strait-Islands-and-Climate-Displacement.pdf

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 Warsaw International Mechanism is currently the primary discussion place of displacement within the UNFCCC. The WIM Executive Committee (WIM Excom) is one of the representative bodies that address on this issue in the context of the UNFCCC. The Taskforce on displacement, established at COP 21 to consider climate induced migration and displacement, finalized its recommendations for the WIM Excom in October 2018.[184] These recommendations based on the stakeholder consultation will be considered at COP24. These are highlighted below (Box 7.1).

The Excom held its seventh meeting in from March 13 to 16 in Bonn, Germany,[185] and its eighth meeting from 18 to 21 September 2018. The 7th meeting took note of reporting from the Task Force on Displacement (Box 7.1), 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 COP 24. 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.[186]

The May Climate Conference in Bonn included a Suva Expert Dialogue, which saw historic decision making for loss and damage, correlating with the 5 year anniversary of the Warsaw International Mechanism.

The May Climate Conference in Bonn also 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.[187] The

184 https://unfccc.int/sites/default/files/resource/2018_TFD_report_17_Sep.pdf
185 https://unfccc.int/node/39764
186 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
187 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

Box 7.1. Recommendations to the WIM Excom by Task Force on Displacement

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.

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.[188] 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. Moving toward COP 24 in December 2018, there will be 17 events focused on disaster displacement related topics, showing the growing importance and recognition of climate induced displacement.[189] The Excom will mark the 5-year anniversary of the establishment of the Warsaw Mechanism at COP 24.

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.[190] The report indicates high 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.[191] The same report points out that the understanding of the linkages of 1.5ºC and 2ºC on human migration are limited, and this also indicates the challenge of overall knowledge gap on climate-induced displacement and migration.

The IPCC Special Report on Global Warming of 1.5°C indicates high agreement that the impacts of 1.5°C of climate warming would disproportionately affect disadvantaged and vulnerable populations through population displacement, among other effects.

Conclusions

While 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 in 2018 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.

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

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

190 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.

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

8. 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

8.1 Tracking Public Financing of Ocean Conservation and Climate Action

The ROCA initiative emphasized the feedback loops between climate change and other human-related drivers of change in the ocean, where multiple stressors cause cumulative impacts, which in turn affect the ability of the ocean to provide a range of services essential to the social and economic well-being of many communities and societies.[192, 193] The inter-relationship of these different human-related drivers of change in the ocean, including climate change, suggests the need to consider climate action (defined here as mitigation and adaptation efforts) and conservation (defined here as both the protection of ecosystems and the sustainable management of natural resources) together in the ocean space (including the coasts). Essentially, efforts to take climate action in the ocean space can also enhance conservation, and viceversa. For this reason, these efforts are grouped together as ocean conservation and climate action, and levels of public financing measured accordingly. In terms of grouping ocean conservation efforts and climate action together, these can be defined in terms of the inter-related targets of various Sustainable Development Goals (SDGs): SDG 14 for ocean conservation, SDG 13 for climate action, and SDG 7 for renewable energy.194

Types of Public Financing Available for Ocean Conservation and Climate Action

Many of the countries that depend most heavily upon the services provided by the ocean are low-income and lower middle-income countries,195 where the costs of ocean conservation and climate action may be an obstacle. As such, the international community has pledged to mobilize financing for both ocean conservation and climate action, often from public sources.[196, 197, 198, 199] This financing typically is provided in the form of grants, concessional investments, or mature debt and equity investments, the latter by private institutions. Public institutions–operating at the national or international level–typically provide financing to support ocean conservation and climate action in developing countries in the form of either grants or concessional loans, referred here as public financing (private organizations may also provide this form of financing, e.g. philanthropies providing grants, or impact investors providing concessional debt).[200]

Characterizing public financing to developing countries for ocean conservation and climate action would include tracking financial flows from national sources (e.g. government aid agencies) as well as international sources. Public financing at the international level is typically provided by the Global Environment Facility (GEF), the Green Climate Fund (GCF), the World Bank and/ or the regional development banks (e.g. the African Development Bank, the Asian Development Bank and the Inter-American Development Bank). Additionally, many of these financial mechanisms include specific climate funds such as the GEF Special Climate Change Fund, the GEF Least Developed Countries Fund, and specific climate change funds at the African Development Bank and the Asian Development Bank (see Towards a Strategic Action Roadmap on Oceans and Climate for more detail).[201]

Description of an Ongoing Baseline Analysis of Public Financing of Ocean Conservation and Climate Action

Since 2016 a number of efforts have been undertaken to start to track public financing of various aspects of

192 Cicin-Sain et al. 2016 Toward a Strategic Action Roadmap on Oceans and Climate. Global Ocean Forum: Washington, D.C.
193 http://ipcc.ch/report/ar5/
194 https://sustainabledevelopment.un.org/#
195 https://openknowledge.worldbank.org/bitstream/handle/10986/26843/115545.pdf?sequence=1&isAllowed=y
196 http://www.un.org/ga/search/view_doc.asp?symbol=A/RES/71/312&Lang=E
197 https://undocs.org/A/RES/69/313
198 http://unfccc.int/files/essential_background/convention/application/pdf/english_paris_agreement.pdf
199 https://undocs.org/A/RES/69/15
200 https://www.edf.org/sites/default/files/documents/financing-fisheries-reform.pdf
201 Cicin-Sain et al. 2016 Toward a Strategic Action Roadmap on Oceans and Climate. Global Ocean Forum: Washington, D.C.

Type of Intervention	SDG 14 Target	Sub-Category of Intervention		SDG 14 Target	Other Targets (SDGs, ROCA)	% to SIDS
Ocean pollution reduction measures	14.1					
Coastal and ocean ecosystem management and protection measures	14.2	Coastal and ocean protected area measures		14.5		
		Measures explicitly targeted to help ocean ecosystems adapt to climate-related impacts	Ocean temperature increases		13.1; ROCA	
			Sea level rise and storm surge			
			Acidification	14.3		
		Measures explicitly aiming to enhance coastal sinks of greenhouse gases			ROCA	
		All other coastal and ecosystem management and protection measures				
Ocean fisheries management measures	14.4	Measures targeted to support small-scale fisheries	14.7			
Measures to help coastal populations adapt to climate-related impacts (including percentage dedicated to displacement impacts					13.1; ROCA	
Measures to reduce ocean-linked anthropogenic sources of greenhouse gases					ROCA	
Measures to increase ocean-based sources of renewable energy					7.2; ROCA	

ocean conservation.[202, 203, 204, 205] These initial efforts have not typically integrated both marine conservation and climate action, and/or explicitly linked flows to specific SDG targets. In order to assess flows of public financing from international sources to ocean conservation and climate action in the context of the SDGs, an analysis is currently underway to carry out a ROCA-sponsored analysis by lead investigators Dr. John Virdin and Mr. Tibor Vegh at Duke University, using the following draft framework:

The above framework is being applied initially to international sources of public financing operating at the global level–the Green Climate Fund, the GEF and the World Bank–and could eventually be applied to those at the regional level, as well as national sources. The aim would be to provide a comprehensive baseline of public financing, that could be compared to estimates of the levels of financing that would be needed to meet the needs related to the oceans and climate nexus and to relevant SDG targets. For ocean conservation alone, these estimates are not systematically available, but for climate action related to the ocean (including the coasts), countries have submitted 'nationally determined contributions' (NDCs) for the Paris Agreement that include cost estimates. These latter estimates can be compared to the baseline of public financing, to generate a rough picture of any financing gap that may exist for achieving internationally-agreed targets related to the ocean.

8.2 Innovative Sources of Ocean Financing

Innovative financing, including accessing capital markets, represents a promising opportunity for delivering ocean solutions, including for critically threatened ecosystems such as coral reefs and for the high seas[206]. It is urgently needed to deliver the significant funding required to address ocean-climate challenges, including mitigation, adaptation and resilience. The innovative financing approach is already used in sustainable development and climate finance. Innovative potential sources of ocean financing not only include large pools of private capital that can potentially be accessed but also new structures and mechanisms that can facilitate the flow of funds into the sector. Corporate climate bonds provide an example of private-sector finance for renewables, future "blue bonds" for ocean solutions and environmental impact and sustainability bonds for instance for example for coastal resilience and nature-based infrastructure could provide formats that would deliver cash up front and could include performance-based components would allow risk sharing and faster delivery. The recently launched first blue bond by the Seychelles[207] includes some of these elements. The Pacific Ocean Finance[208] paper summarises efforts in that region.

One mechanism to foster broader ocean engagements

202 http://fundingtheocean.org/
203 Blasiak, R. and Wabnitz, C. 2018. Aligning fisheries aid with international development targets and goals. Marine Policy 88: 86-92.
204 https://nicholasinstitute.duke.edu/publications/strengthening-governance-small-scale-fisheries-initial-assessment-theory-and-practice
205 IUCN. 2018. Considering Oceans in the Climate Regime: Opportunities and Strategic Considerations. ClimateFocus.
206 Thiele, T. & Gerber, L. 2017. Innovative Financing for the High Seas.Aquatic Conserv,
207 https://www.worldbank.org/en/news/press-release/2018/10/29/seychelles-launches-worlds-first-sovereign-blue-bond
208 https://docs.wixstatic.com/ugd/9b71e9_924c8a4d7382489685f30cf70b0ea924.pdf

are voluntary commitment processes. $13.5 billion in funding for ocean projects in SIDS was included in the voluntary commitments registered at the UN Oceans Conference in 2017[209] The fifth Our Ocean Conference in Indonesia in October 2018 delivered a broad range of commitments for a number of predetermined areas of action, with 305 measurable commitments and a USD 10,7 billion monetary total.[210] Private sector and philanthropic partners not only provided specific and tangible funding for ocean exploration[211] but also the delivery of mitigation and adaptation targets such as through reef and mangrove restoration, natural infrastructure, verified carbon offsets, reduction on GHG emissions from shipping and seafood production.

They also focused on supporting the development of innovative financing and support structures itself, such as the Global Fund for Coral Reefs, the Caribbean Climate-Smart Accelerator[212] and the Ocean Risk Initiative[213]. By bringing together multiple private and public partners in these efforts, including the International Alliance to Combat Ocean Acidification[214] and the Ocean & Climate Initiatives Alliance[215], private funding sources are effectively levered to encourage cooperation and engagement. These partnerships support both technology and finance innovation, which can and will need to include innovative formats for greater inclusion, for transparency and traceability and for funding support at the bottom of the pyramid and marginalized communities. Community savings schemes that support engagement in sustainable marine activities such as seaweed farming, crowdsourcing efforts and prize competitions for marine technology and ocean protection solutions, accelerator formats for blue start-ups, insurance for blue natural capital assets, blockchain concepts for seafood transparency and ocean data finance efforts all represent examples of innovative ocean finance. They are part of an emerging ocean fin-tech space that will be key to deliver a new marine funding paradigm that effectively complements traditional public finance.

A key constraint for private funding of ocean solutions is the lack of clear metrics and parameters for investment. Progress made over the last year include increased engagement of the insurance industry around the concept of ocean risk[216], the development of a blue natural capital approach, and the launch of key principles for sustainable fisheries[217] and for blue economy finance[218] in 2018. New private sector ocean impact investors are emerging, targeting small-scale fisheries and seaweed farming, marine plastics and coastal resilience. Common approaches to project pipeline development, a

209 https://sustainabledevelopment.un.org/content/ documents 16542Short_Analysis_of_Voluntary_Commitments.pdf 95
210 https://ourocean2018.org/?l=our-ocean-commitments
211 for example REV Ocean (http://inpublic.globenewswire.com/releaseDetails.faces?rId=2222968)
212 https://www.caribbeanaccelerator.org
213 https://chinadialogueocean.net/2760-better-insurance-is-vital-to-protecting-our-ocean/
214 https://www.oaalliance.org
215 https://ocean-climate-alliance.org
216 https://www.iucn.org/news/marine-and-polar/201805/ocean-risks-a-wake-call-policymakers-iucn-report
217 http://www.fisheriesprinciples.org
218 https://ec.europa.eu/maritimeaffairs/sites/maritimeaffairs/files/declaration-sustainable-blue-economy-finance-principles_en.pdf

focus on critical ecosystems, impact metrics and risk reduction that align these with blue bioeconomy[219] and blue carbon[220] concepts. conservation safeguards and the sustainable development goals in line with the approaches taken by leading multilateral finance organisations are key to scale private finance.

Next, ocean finance innovation needs to move beyond these early adopter to the main markets of major lending banks, large asset managers and pension funds and key capital market structurers to deliver effective private sector funding at scale. The European Commission's Action Plan on Financing Sustainable Growth of March 2018 outlines key next steps to develop the framework for mobilising private capital for sustainable projects, including for natural capital and marine resources[221]. Expectations on ocean sustainability[222] need to be presented and business government pathways aligned with the latest in ocean science on the basis of the IPCC 1.5 degrees special report[223]. Private sector funding will benefit not only from tools such as the proposed oceans supplement to the natural capital protocol[224] but from clear regulatory frameworks that encourage the financing of ocean and climate aligned renewable, zero waste and biodiversity-supportive projects. The roll-out of sustainable infrastructure in line the Agenda 2030 provides a US$70 trillion opportunity that can only be met through a public-private partnership approach that draws on innovative private finance and needs to be ocean-aware in order to address the challenges facing our blue planet.

219 for Europe see: http://www.eumofa.eu/documents/20178/84590/Blue+bioeconomy_Final.pdf
220 https://onlinelibrary.wiley.com/doi/epdf/10.1002/aqc.2793
221 see Footnote 40 of https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52018DC0097
222 as was done by Norges Bank in September 2018: https://www.nbim.no/en/transparency/news-list/2018/expectations-on-ocean-sustainability/
223 http://www.ipcc.ch/meetings/session44/l2_adopted_outline_sr15.pdf
224 https://naturalcapitalcoalition.org/projects/oceans-supplement/

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.

A changing climate has made imperative the need for the development of ocean-based mitigation, adaptation and scientific monitoring capacities of developing states, in particular the most vulnerable SIDS and coastal Least Developed Countries. Capacity building for developing countries would enable them to implement their commitments under the Paris Agreement through their NDCs. In 2018, progress in capacity development related to oceans and coasts both within the UNFCCC and outside are described below.

The IPCC special report on the impacts of global warming of 1.5 °C above pre-industrial levels indicated that "mitigation and adaptation consistent with limiting global warming to 1.5°C are underpinned by enabling conditions, assessed in SR1.5 across the geophysical, environmental-ecological, technological, economic, socio-cultural and institutional dimensions of feasibility."[225] The report identified, with a high level of confidence, that strengthened multi-level governance, institutional capacity, policy instruments, technological

225 IPCC (2018) Global Warming of 1.5 °C. Summary for Policymakers. http://www.ipcc.ch/pdf/special-reports/sr15/sr15_spm_final.pdf

innovation and transfer and mobilization of finance, and changes in human behavior and lifestyles are enabling conditions that improves the feasibility of mitigation and adaptation options for 1.5°C.

Moreover, the report indicated, with high confidence, that strengthening the capacities for climate action of various stakeholders can support the implementation of ambitious actions implied by limiting global warming to 1.5°C. International cooperation, a critical enabler for developing countries and vulnerable regions, can provide an enabling environment for this to be achieved in all countries and for all people, in the context of sustainable development.[226]

As well, the report indicated that cooperation on strengthened accountable multilevel governance that includes non-state actors such as industry, civil society and scientific institutions, coordinated sectoral and cross-sectoral policies at various governance levels, gender-sensitive policies, finance including innovative financing and cooperation on technology development and transfer can ensure participation, transparency, capacity building, and learning among different players, with high confidence.[227]

9.1 Advances on Capacity-Building under the Paris Committee on Capacity-Building

The Paris Committee on Capacity-Building (PCCB) was established with the aim to "address gaps and needs, both current and emerging, in implementing capacity-building in developing country Parties and further enhancing capacity-building efforts, including with regard to coherence and coordination in capacity-building activities under the Convention."[228] Progress in the implementation of the Paris Committee on Capacity-building (PCCB) rolling workplan for 2017-2019 follows.[229]

Work on Strengthening Linkages with the Constituted Bodies and Other Actors and Processes Under and Outside the Convention

- It was agreed that the PCCB would work on the issue of loss and damage in the context of its rolling workplan for 2017–2019 and its ongoing work on capacity gaps and needs as a result of a meeting between PCCB and the Warsaw International Mechanism representatives.
- The PCCB made progress in engaging with constituted bodies on how to better link existing knowledge and information resources under the Convention. Activities undertaken in linking various knowledge portals are described in chapter IV.B.3 of the PCCB 2018 progress report.
- Areas for collaboration between PCCB and the NDC Partnership were identified at a meeting held during the 2nd PCCB meeting, which include: (1) sharing of knowledge and dissemination of information on capacity-building related to NDC implementation through, for example, linking the NDC Partnership knowledge portal with the capacity-building portal, and a social media project to be launched by the PCCB prior to COP 24; (2) exchange of information and knowledge on capacity gaps and needs related to NDC implementation at the national level; and (3) potential engagement of PCCB members in future NDC Partnership workshops or forums, particularly at the regional level. Collaborative activities have started and are expected to continue throughout 2018.
- During the forty-eighth sessions of the subsidiary bodies, the PCCB Co-Chairs met with the high-level champions of global climate action to discuss opportunities for collaboration in the context of the Marrakesh Partnership for Global Climate Action, including, for example, during regional climate weeks. As a result of the meeting, the PCCB actively participated in the Latin American and Caribbean Climate Week, held from 20 to 23 August 2018 in Montevideo.
- On the sidelines of the forty-eighth sessions of the subsidiary bodies, the PCCB Co-Chairs met with a representative of the Capacity-building Initiative on Transparency (CBIT) to explore opportunities for collaboration. The CBIT, inter alia, supports assessments of capacity-building gaps and needs related to transparency, and further exchange is planned to identify opportunities to link these efforts with the work of the PCCB on identifying capacity gaps and needs. Other avenues for collaboration discussed include linking the CBIT platform with the capacity-building portal, and extending invitations to PCCB members to participate in regional meetings of the CBIT.
- To continue to benefit from the perspectives and knowledge of stakeholders in implementing its rolling workplan, the PCCB, in April 2018, launched an open call for submissions from interested stakeholders.

Work on Addressing Cross-cutting Issues

- Following discussions with relevant stakeholders at its 2nd meeting, the PCCB highlighted that it will initially cover the following cross-cutting issues: (a) Gender responsiveness; (b) Human rights and just transition; (c) Indigenous peoples' knowledge; (d) Role of cities; (e) Youth and Action for Climate Empowerment elements. To date, significant progress

226 Ibid.
227 Ibid.
228 FCCC/CP/2015/L.9/Rev.1. Decision, Paragraph 72
229 UNFCCC (2018). Annual technical progress report of the Paris Committee on Capacity-building. FCCC/SBI/2018/15. https://unfccc.int/sites/default/files/resource/15.pdf

has been made regarding gender responsiveness, human rights and the role of cities.

- Regarding gender responsiveness, the PCCB and the secretariat are collaborating on activities to build the capacity of PCCB members and invited members of other constituted bodies for integrating gender considerations into climate action.
- Concerning the cross-cutting issue of human rights, the PCCB, in collaboration with the Office of the United Nations High Commissioner for Human Rights (OHCHR) and the Mary Robinson Foundation – Climate Justice (MRFCJ), has begun preparations for a joint side event at COP 24 on building capacity for the integration of human rights into climate action, including in the context of implementing NDCs.
- On the role of cities, members of the PCCB working group on cross-cutting issues met with representatives of ICLEI – Local Governments for Sustainability during the forty-eighth sessions of the subsidiary bodies to develop initial ideas for further collaboration, followed by further exchange on how to enhance the understanding of capacity gaps and needs at the city level and to catalyze the exchange of lessons learned, examples and methodologies in addressing those gaps and needs.

Work on Enhancing the Capacity-building Portal

The PCCB, through its working group on enhancing the capacity-building portal, made significant progress in providing guidance to the secretariat on the maintenance and further development of the portal. In order to do this, it drew on information contained in the submissions of Parties and non-Party stakeholders on the enhancement of the capacity-building portal, a background paper prepared by the secretariat to support the portal-related deliberations at the 2nd meeting of the PCCB and relevant inputs from participants at the first two meetings of the PCCB, as well as on information available from web-based initiatives and resources.

Work on Identifying Capacity Gaps and Needs

- In addition, the PCCB identified the need to gather more in-depth information on the capacity-building challenges related to NDC implementation at the country level in order to be able to develop informed and balanced policy recommendations to the COP. The PCCB, therefore, agreed at its 2nd meeting to launch a pilot exercise at the national level to assess capacity gaps and needs in implementing NDCs, which aims to capture gaps and needs in the following areas: (a) Institutional capacity for governance and coordination; (b) Technical capacity, including sectoral expertise, for modelling and evaluation; (c) Relational capacity for building partnerships and investing time in processes; (d) Strategic capacity for systemic policy design and implementation.
- The PCCB intends to collaborate closely with relevant stakeholders, including the NDC Partnership, to make use of existing knowledge and available information related to capacity-building for NDC implementation and to develop and utilize synergies.

9.2 Other Capacity Building Efforts

Other notable developments on capacity building relevant to oceans and coasts include the following examples noted below.

- Institutional Capacities for NDC Implementation - A Guidance Document (UNEP DTU Partnership)[230]

This document describes the types of capacities needed, identifies areas where developing country government capacities are generally limited, and provides recommendations for building these capacities.

- Blue Training Courses[231]

A new set of free-of-charge toolkits to assess and address emissions from ships and ports is now available from the IMO. The guides are designed to help countries develop and strengthen national policy and regulatory frameworks related to the prevention of air pollution and the reduction of greenhouse gas emissions from ships. They provide practical guidance on assessing emissions, so that a national emission reduction strategy for the maritime sector can be developed. Developed under the GEF-UNDP-IMO Global Maritime Energy Efficiency Partnerships (GloMEEP) Project, in collaboration with its strategic partners, the Institute of Marine Engineering, Science and Technology (IMarEST) and the International Association of Ports and Harbors (IAPH), both toolkits have been developed through extensive testing and feedback from practical use of the toolkit guides during national and regional training activities held in the 10 lead pilot countries participating in the GloMEEP project.

- Capacity Development Workshop - Financing NDC Implementation in the Energy Sector (IRENA)232

Co-organized by the Government of Burkina Faso, Global Green Growth Institute (GGGI) and Green Climate Fund (GCF) and IRENA, the workshop provided

230 UNEP DTU Partnership (2018) Institutional Capacities for NDC Implementation. A Guidance Document. http://www.unepdtu.org/newsbase/2018/03/new-guide-building-capacity-to-implement-ndcs?id=2814dfb1-37fc-41e6-8626-22277a30efca

231 MarEx (2018) IMO Releases Ship and Port Emissions Toolkits https://www.maritime-executive.com/article/imo-releases-ship-and-port-emissions-toolkits

232 IRENA (2018) Capacity Development Workshop - Financing NDC Implementation in the Energy Sector. http://www.irena.org/events/2018/Jun/Capacity-Development-Workshop---Financing-NDC-Implementation-in-the-Energy-Sector

an opportunity to discuss renewable energy project formulation by a small number of target countries in West Africa (Burkina Faso (the host), Senegal, Cote d'Ivoire, Mauritania and Mali). The workshop aimed to: (i) enhance capacity for the planning of Nationally Determined Contribution (NDC) implementation, share experiences, best practices, and opportunities and associated challenges in the region, (ii) enhance knowledge on the methodology used to develop the NDC implementation plan and linkage with SDGs, and (iii) enhance knowledge on climate finance needs for NDC implementation and strengthen the role of the private sector in the implementation of NDCs. These objectives will assist countries in implementing renewable energy components of NDCs.

- **Adaptation Futures 2018 (5th International Climate Change Adaptation Conference), 18-21 June 2018, Cape Town, South Africa[233]**

This conference addressed capacity building as part of resourcing adaptation in a plenary session, which explored how to resource adaptation, especially in developing countries. While financing and the economics of adaptation is important, the session aimed to go beyond finance to explore other resourcing issues, including knowledge resources, human resources and capacity, and enabling institutional and governance arrangements.

Promote the Further Enhancement of Marine Policy Centers in Developing Countries and SIDS to Build Capacity in Management and Policy Related to Oceans and Climate.

At the Global Climate Action Summit (12-15 September 2018, San Francisco, California),[234] the importance of the oceans to climate action was firmly highlighted alongside other sectors. Commitments were made to further global ocean stewardship and conservation in line with global warming mitigation and resiliency efforts, including: ocean technologies, coastal advocacy, new members of the Ocean Acidification Alliance, and pledges to plant thousands of coral.

At the Summit, the World Ocean Council (WOC) announced a major new global effort to assist Small Island Developing States (SIDS) to:

- Engage and advance business leadership and collaboration in port adaptation and resilience.
- Overcome resource constraints and institutional barriers to planning for adaptation.
- Establish the local "enabling conditions" that can catalyze private sector engagement needed for port adaptation, including finance.

The project will be developed and tested for replicability so that the program can scale globally to support port/coastal infrastructure adaptation needs in SIDS and in archipelagic and coastal developing countries in collaboration with the Green Climate Fund (GCF) and other key multilateral and bilateral partners. The project will undertake the multi-phase approach necessary to engage the private sector in ports and coastal infrastructure adaptation and resiliency in SIDS and archipelagic and coastal developing countries, starting with capacity building for engaging the private sector.

To strengthen capacities among decision-makers, the Blue Solutions Initiative developed four modular training courses – the Blue Training Courses – focusing on climate change adaptation, ecosystem services, conservation finance and marine spatial planning. The training courses, which are all open source and available online are the following: Blue Climate Change and Adaptation (CCA, 3-5 training days); Blue Integrating Ecosystem Services (3-5 training days); Blue Conservation Finance course (1-2 days); The Blue Planning in Practice (BPiP, 5 training days).[235]

Support the preparation of the IPCC report on oceans and the cryosphere--to integrate and update the assessment of AR5 using scientific findings on the central role of oceans and climate and likely scenarios and consequences.

The IPCC report on oceans and the cryosphere is under development and is scheduled for completion and approval by September 2019.

Include sustained ocean observation as part of national commitments, particularly within the framework of the UNFCCC and Agenda 2030/ SDG 14 (target 14.a), in response to the call to increase knowledge to manage marine ecosystems sustainably, and understand the impacts of climate change and ocean acidification.

The Global Compact for Safe, Orderly and Regular Migration is the first-ever UN global agreement on a common approach to international migration in all its dimensions. The global compact is non-legally binding. It is grounded in values of state sovereignty, responsibility-sharing, non-discrimination, and human rights, and recognizes that a cooperative approach is needed to optimize the overall benefits of migration, while addressing its risks and challenges for individuals and

233 Adaptation Futures 2018 (5th International Climate Change Adaptation Conference), 18-21 June 2018, Cape Town, South Africa. Resourcing Adaptation. https://adaptationfutures2018.capetown/wednesday-plenary/

234 Global Climate Action Summit, 12-15 September 2018, San Francisco, California. Outcomes. Coasts and Oceans. https://www.globalclimateactionsummit.org/summit-outcomes/

235 Köngeter, A. (2018) Blue Training Courses – four open source trainings focusing on marine and coastal ecosystems. https://www.adaptationcommunity.net/blue-training-courses-four-open-source-trainings-focusing-on-marine-and-coastal-ecosystems/

communities in countries of origin, transit and destination. Among its 23 objectives, the Compact strives to create conducive conditions that enable all migrants to enrich our societies through their human, economic and social capacities, and thus facilitate their contributions to sustainable development at the local, national, regional and global levels.[236] The Compact is scheduled for adoption at an intergovernmental conference to be held on 10 – 11 December in Marrakech, Morocco.[237]

At the 5th Our Ocean Conference held in Bali, Indonesia on 29-30 October 2018,[238] governments, NGOs and corporate sector as well as UN entities, academia, scientific community and philanthropic organizations submitted ocean commitments, which included the following relevant to capacity development.

- Indonesia in collaboration with Grid-Arendal committed to allocate USD 500.000 to USD 1.0 million in 2019 under Blue Forest Project. The project will highlight the effort to demonstrate methodologies and approaches for carbon accounting and ecosystem services valuation in coastal and marine ecosystems. Improving the understanding of ecosystem services, carbon sequestration, storage, avoided emissions and management in mangroves and seagrass ecosystems at six project sites covering maximum of 100,000 ha; and improving capacity and ecosystem management as a result of the application of methodologies and approaches to the sites project area.
- Ireland committed USD 1.15 million over a five-year period (2019-2024) towards a new programme of Ocean and Climate research in an Irish Higher Education Institution. This investment will target capacity building, novel research and delivery of societally-relevant knowledge outcomes aimed at better understanding the complex interactions between the ocean and climate change. This research will contribute to international climate policy, supporting enhanced forecasting capabilities and contributing to adaptation and mitigation strategies and actions.
- Ocean Conservancy with the government of Chile, Varda Group, Prince of Monaco II Foundation, World Resources Institute, and potentially other governments, will launch a partnership to advance the incorporation of the ocean into countries' Nationally Determined Contributions under the Paris Agreement. This partnership will develop model "Ocean NDCs" for select countries, and related guidelines and toolkits that other countries can use to develop their own ocean content. It will include allocation of significant resources and capacity to oversee the implementation of regional workshops around the globe which will bring together scientists and ocean policy experts to assist countries to develop robust 'ocean NDCs' which will incorporate ocean conservation elements that can help countries both deliver on their climate goals and to help build resilience for coastal communities and ecosystems to guard against growing impacts from climate change.

236 Global Compact for Migration (2018). Global Compact for Safe, Orderly and Regular Migration. https://refugeesmigrants.un.org/sites/default/files/180713_agreed_outcome_global_compact_for_migration.pdf
237 United Nations (2018) Global compact for migration. https://refugeesmigrants.un.org/migration-compact
238 Our Ocean, Bali, 29-30 October 2018. Our Ocean Commitments. https://ourocean2018.org/?l=our-ocean-commitments

10. OCEANS AT COP 24, KATOWICE, POLAND

Given the findings discussed through this report, it is more urgent than ever that oceans be showcased at COP 24 in Katowice, Poland. Since the Ocean and Coastal Zone Thematic Area became one of the seven priorities to be fast-tracked under the Marrakech Partnership for Global Climate Action at COP 22 in Marrakech in 2016, strong progress has been achieved in mobilizing UNFCCC State Parties to address the oceans and climate nexus at global, regional, and national levels, as well as through the actions of many NGOs and IGOs. At COP 24, Oceans Action Day will feature five interlinked segments to be held on December 8, 2018 all day at the International Congress Centre: 1) Marrakech Partnership Ocean and Coastal Zones Action Event; 2) The Oceans and Climate Nexus: Addressing Major Issues (new science on the ocean and climate nexus, and how to incorporate these scientific findings into the UNFCCC process; adaptation and population displacement; ocean nationally determined contributions (NDCs) and ocean financing; 3) Actions on Ocean Acidification—The Other CO2 Problem; 4) High Level Closing and Looking Ahead; 5) Reception. As well, the organizers of the Oceans Action Day at COP 24 will collaborate with all other ocean events being organized at COP 24 in producing joint reporting on results achieved.

The participation of State Parties will be emphasized in all COP 24 ocean segments, and State Parties will be especially invited to a *Gathering of the Friends of the Ocean at the UNFCCC*, to consider possible ocean actions for the period 2019-2021.

For additional information, please contact:

Biliana Cicin-Sain, Global Ocean Forum
Email: bilianacicin-sain@globaloceans.org

Julian Barbiere, Intergovernmental Oceanographic Commission (IOC-UNESCO)
Email: j.barbiere@unesco.org

Tiago Pitta e Cunha, Oceano Azul Foundation, Portugal
Email: tpcunha@oceanoazulfoundation.org

Miko Maekawa, Ocean Policy Research Institute of the Sasakawa Peace Foundation, Japan
Email: maekawa@spf.or.jp