Assessing Progress on Ocean and Climate Action: 2016-2017

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

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COP 23 Version for Comment

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Marrakech Partnership

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1. Introduction

The ***Strategic Action Roadmap on Oceans and Climate: 2016 to 2021*** was written as a proposed vision for action regarding oceans and climate policy in the next five years.[1] This vision was imbued with a sense of urgency by the landmark Paris Agreement. Policy recommendations for the Roadmap were derived from discussions at the Oceans Day during UNFCCC COP 21 in Paris in December 2015, which brought together over 400 participants highlighting the central relationship between oceans and climate, as well as the importance of healthy oceans to human wellbeing. The recommendations are organized into six interrelated ocean and climate themes: The central role of oceans in regulating climate, mitigation, adaptation, displacement, financing, and capacity development.

The Roadmap was then prepared and refined by a group of 37 experts from 46 of the partner organizations of Oceans Day at COP 21, coordinated by the Global Ocean Forum; IOC-UNESCO; UN Environment; the Ocean Policy Research Institute of the Sasakawa Peace Foundation; and the University of Delaware. For each of the six themes, the authors were asked to present: 1) the current status of the issue (and, as relevant, the science related to the issue); 2) the current state of play of the issue within the UNFCCC; 3) the opportunities and pathways that may be available within the UNFCCC to advance the issue in the next five years; 4) the opportunities and pathways that may be available outside of the UNFCCC to advance the issue; and 5) financial considerations regarding the issue.

The **Roadmap to Oceans and Climate Action (ROCA) Initiative** (involving Parties, NGOs, academic institutions, and UN agencies) was then launched at the Oceans Action Day at UNFCCC COP 22 in Marrakech, Morocco in November 2016, to begin implementation of the Roadmap recommendations. There was a strong presence of ocean stakeholders at COP 22; the high-level UNFCCC Global Climate Action Champions included oceans as a major theme in the Marrakech Partnership for Global Climate Action. 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; working with national and local level leaders to implement specific actions furthering the Roadmap goals; tracking public climate financing towards oceans; and developing recommendations on how to support ocean-based mitigation and adaptation goals in Nationally Determined Contributions (NDCs), particularly those of Small Island Developing States (SIDS). A report on how to best support ocean-based actions in NDCs and on a mechanism to track climate financing towards ocean issues are both in progress by ROCA at the time of this writing.

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. Fortunately, some of the recommendations in the Roadmap are conducive to a quantitative approach; for example, it is relatively simple to track progress toward a percentage of all 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 six themes in the Roadmap, as well as considering Blue Economy as an additional theme. 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 22; 2) examples of the recommendation being

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

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 should feel welcome to contact the authors with comments and contributions.

Partnership with the Ocean and Climate Initiatives Alliance: A Companion Report

A companion report to this ROCA report, entitled the Measuring Progress on Ocean and Climate Initiatives: An Action-Oriented Report, was prepared by the Ocean and Climate Initiatives Alliance (OCIA).[2] The OCIA report relies on a survey of various international ocean initiatives reporting on the progress they have made towards climate mitigation and adaptation, with an emphasis on progress since COP 21 in Paris. When taken together, the two reports will hopefully provide a well-rounded picture of progress in oceans and climate policy and action since the Paris Agreement. Both reports will be presented at the Oceans Action Day at UNFCCC COP 23 in Bonn, Germany, on November 11, 2017.

The OCIA was launched in February 2017, supported by the Ocean and Climate Platform, IOC-UNESCO, and France together with other signatories of the Because the Ocean declaration.[3] Its objective is to bring together worldwide initiatives around a common action framework to implement the Paris Agreement, particularly in light of the close connection between the ocean and the climate. Its members include specific initiatives by UN agencies, international partnerships advancing research and awareness of specific issues, scientific institutions, non-governmental organizations, and regional governments. In addition to producing the aforementioned report, the OCIA works to foster collaboration between international initiatives as a catalyst for progress, moving forward the cutting edge of science, as well as ensuring that civil society initiatives have a voice in international fora.

2 Picourt, L., de Courcy, C., and Brun V. et al. 2017. Measuring Progress on Ocean and Climate Initiatives: An Action-Oriented Report, OCEAN AND CLIMATE PLATFORM. Available at: https://ocean-climate-alliance.org/ November 2016, available at http://www.vardagroup.org/wp-content/uploads/2016/11/BTO-2-FINAL_14Nov.pdf

2. The Role of Oceans in Climate

Roadmap Recommendation: Recognize the central role of the ocean in climate and the need to implement stringent reductions in greenhouse gas emissions to avoid disastrous consequences on coastal and island communities, marine ecosystems, and ocean chemistry.

A discussion of the Central Role of the Ocean in Climate includes updates on ocean and climate research, public awareness, and policy actions within the last year. This section provides overviews of major conferences, agreements, announcements, etc., that are broad in scope and related to ocean and climate policy.

Ocean and Climate Science in 2016-2017

Scientists have continued to monitor the effects of climate change on the oceans and cryosphere, from a rapidly melting Arctic to ongoing sea level rise to the progression of ocean acidification. The past few years have been landmark years for climate change benchmarks.

Ocean Warming

2016 was the hottest year on record; breaking the previous records of 2015 and 2014. Based on the first eight months, 2017 is expected to be in the top five hottest years on record (WMO 2017).[1] Global sea surface temperatures reached a record high in 2016, with the hottest temperature anomalies occurring in the North Atlantic and North Pacific, as well as parts of Indonesian and Australian waters.[2] In January 2017, scientists confirmed that global concentrations of atmospheric CO_2 are now above 400 ppm even at their yearly minimum (NASA 2017).[3] In the preindustrial era, concentrations were never above 290

1 World Meteorological Organization. Statement on the State of the Global Climate in 2016. WMO: Geneva, 2017. https://library.wmo.int/opac/doc_num.php?explnum_id=3414

NASA's Goddard Institute for Space Studies. "July 2017 equaled record July 2016." https://climate.nasa.gov/news/2618/july-2017-equaled-record-july-2016/

2 World Meteorological Organization. Statement on the State of the Global Climate in 2016. WMO: Geneva, 2017. https://library.wmo.int/opac/doc_num.php?explnum_id=3414

3 Schmidt, L.J. 2017. "Satellite data confirm annual carbon dioxide minimum above 400 ppm." NASA News. https://climate.nasa.gov/news/2535/satellite-data-confirm-annual-carbon-dioxide-minimum-above-400-ppm/

ppm. The atmospheric CO_2 concentration of 400 ppm is generally considered to be a point of no return, where natural processes as they exist now would not be able to bring levels back to their preindustrial state even if emissions were to stop today due to various feedback processes, such as ongoing permafrost melt.

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The Paris Agreement notably holds nations to the promise to keep warming below 2°C above preindustrial limits, with best efforts to keep it below 1.5°C. Climate scientists have long warned that keeping below 1.5C of warming would be next to impossible unless emissions stop immediately, and a new analysis from the Max Planck Institute for Meteorology confirms this fear using only observations of the climate system as they have already occurred rather than model simulations, which are more widely used. The analysis asserts that additional warming of at least 1.3°C is certain to happen even if emissions stopped in 2017, based on the current concentration of CO_2 in the atmosphere and the effects of this concentration on the Earth's temperature.[4]

The World Meteorological Organization (WMO) releases an annual Statement on the State of the Global Climate, synthesizing yearly data from National Meteorological and Hydrological Services and other scientific organizations. Two of their key findings were directly relevant to oceans and climate; global sea levels reached a record high during the 2015/2016 El Niño at 20 cm above preindustrial levels, and global sea ice extent fell to 4 million km2 below average at its yearly minimum in November 2016. This sea ice extent is almost 30% smaller than the previous November record (WMO 2017). The WMO emphasized that the natural variability seen in El Niño-Southern Oscillation (ENSO) interacted with anthropogenic climate change to push many climate markers to extremes over 2015-2016, and those extremes cannot be attributed to either driver completely.[5]

The WMO connected record warm sea surface temperatures in the western Pacific to the extreme storms and flooding seen in that region in recent years. This region also saw the largest amount of sea level rise in the last few years; about 40% of global sea level rise is caused by expansion due to higher water temperatures. At least 1,200 people were killed in an unusually devastating 2017 monsoon season in Bangladesh, Nepal and India, and aid workers estimate that more than 40 million people were displaced or otherwise affected by the flooding.[6] Central and southeastern China also experienced extreme floods, with more than 50,000 homes destroyed, $430 million in damages, and approximately 100 people killed.

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One of the impacts of ocean warming is coral bleaching. Coral reefs are significant coastal ecosystems, providing habitat for countless species and protecting coastlines from storm surge. Bleaching occurs when high temperatures cause corals to reject their symbiotic photosynthetic algae; coral does not always die when it bleaches, but frequently does. NASA refers to the bleaching that occurred in 2014-2017 as the Third Global Coral Bleaching Event, and confirmed that it was the longest, most widespread, and likely the most damaging coral bleaching event in recorded history. More than 70% of coral reefs worldwide experienced heat levels in 2014-2017 sufficient to cause significant bleaching and coral mortality.[7]

2016 and 2017 saw record-breaking tropical storms. Scientists generally agree that the elevated sea surface temperatures caused by anthropogenic climate change contribute to more intense storms, although the factors that determine tropical storm intensity are complex and difficult to isolate from one another. Cyclone Winston arrived in Fiji in early 2016 as the most intense hurricane at landfall record in that region. In the late summer of 2017; hurricanes Irma and Maria became the first and second most intense hurricanes ever recorded in the Atlantic Ocean basin. Maria intensified from a

4 Mauritsen, T. and Pincus, R. 2017. Committed warming inferred from observations. Nature Climate Change DOI: 10.1038/NCLIMATE3357

5 World Meteorological Organization. Statement on the State of the Global Climate in 2016. WMO: Geneva, 2017. https://library.wmo.int/opac/doc_num.php?explnum_id=3414

6 Siddque, Haroon. "South Asia floods kill 1,200 and shut 1.8 million children out of school." The Guardian. UK: 2017. https://www.theguardian.com/world/2017/aug/30/mumbai-paralysed-by-floods-as-india-and-region-hit-by-worst-monsoon-rains-in-years

7 NASA. 2017. Global Coral Bleaching 2014-2017: Status and an Appeal for Observations. https://coralreefwatch.noaa.gov/satellite/analyses_guidance/global_coral_bleaching_2014-17_status.php

2016 and 2017 saw record-breaking tropical storms... Cyclone Winston arrived in Fiji in early 2016 as the most intense hurricane in that region. Hurricanes Irma and Maria became the first and second most intense hurricanes ever recorded in the Atlantic Ocean basin.

tropical depression to a Category 5 hurricane faster than any other recorded storm. Preliminary estimates of the damages from hurricanes Harvey and Irma would place both hurricanes in the top 5 costliest tropical cyclones; both hurricanes have a chance at surpassing Katrina in 2005 and Sandy in 2012 as the most costly. Hurricane Irma had the longest duration as a Category 5 hurricane of any named storm in history and sustained winds greater than 185 mph longer than any tropical cyclone. As of late October 2017, the vast majority of Puerto Rico remains without power or access to clean water following a direct hit from Irma more than seven weeks prior.

2017 marked the year that the Larson C ice shelf in Antarctica became 10% smaller when a 5800 km^2 chunk of ice broke off in July.[8] Larson A collapsed in 1995 and Larsen B collapsed in 2002, and NASA warns that the collapse of these shelves accelerates sea level by removing barriers for glacial land ice to melt into the sea. A July 2017 study confirmed that the Arctic is experiencing an average of six additional heat waves each winter when compared to the 1980s.[9] These warming events are associated with Arctic winter cyclones that push the sea ice edge farther north and slow growth of the winter ice pack that replaces summer melts. NASA and NOAA research released this year also confirmed that Arctic soils are already accelerating warming as they take longer to freeze in the winter, because they emit stored CO_2 while they are thawed over longer periods than in preindustrial years.[10] These trends near both poles are added pieces to the puzzle that show how feedback loops are accelerating ice melt and sea level rise.

Melting Arctic ice has been shown to impact more than sea level. Researchers in a Yale-led study measured the precise potential change in the Atlantic Meridional Overturning Circulation (AMOC) due to Arctic sea ice loss. The AMOC regulates weather in countries with an Atlantic coast; a well-known portion of the AMOC is known as the Gulf Stream, which keeps average temperatures in western Europe warmer than in other areas of similar latitude. The researchers stated that Arctic sea ice loss alone

8 NASA. "Massive iceberg breaks off from Antarctica." https://climate.nasa.gov/news/2618/july-2017-equaled-record-july-2016/

9 Graham, R.M., Cohen, L., Petty, A.A., Boisvert, L.N., Rinke, A., Hudson, S.R., Nicolaus, M, and Granskog, M.A. 2017. Increasing frequency and duration of Arctic winter warming events. Geophysical Research Letters 44(13): 6974-6983.

10 Gray, E. 2017 "Alaska tundra source of early-winter carbon emissions." NASA News. https://climate.nasa.gov/news/2586/alaska-tundra-source-of-early-winter-carbon-emissions/

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could weaken the AMOC by 30% to 50%, implying that the AMOC is much less stable than previously thought.[11] The article speaks to the importance of understanding the complex ways that the ocean affects our daily lives.

Another 2017 study demonstrating the importance of oceans in regulating climate and weather was an analysis of sea surface temperature data from 1957-2002 compared to land temperatures and water conditions over the same period. Researchers found that sea surface temperature has become more variable, with longer lasting extremes, and these changes have been strongly associated with more extreme and persistent temperature fluctuations on land.[12] The long term droughts in the Eastern Mediterranean and the western United States appear strongly linked to these changes in ocean surface temperature variability. Another study found that the difference in temperature between the Pacific and Atlantic Oceans influences the frequency of wildfires and droughts in the United States, and a warmer Atlantic compared to the Pacific produces more drought.[13] This is significant because the Atlantic is warming faster than the Pacific.

New research supported by NASA in early 2017 confirmed that there will be a limit to the amount of heat and gas that the ocean can absorb to mitigate atmospheric warming, and they have already absorbed over 30% of the heat added to the global system since the

11 Sevellec, F., Fedorov, A.V., and Liu, W. 2017. Arctic sea-ice weakens the Atlantic Meridional Overturning Circulation. Nature Climate Change DOI: 10.1038/nclimate3353

12 Lenton, T.M., Dakos, V., Bathiany, S., and Scheffer, M. 2017. Observed trends in the magnitude and persistence of monthly temperature variability. Scientific Reports 7(1) DOI: 10.1038/s41598-017-06382-x

13 Chikamoto, Y., Timmermann, A., Widlansky, M.J., Balmaseda, M.A., and Stott, L. 2017. Multi-year predictability of climate, drought, and wildfire in southwestern United States. Scientific Reports 7(1) DOI: 10.1038/s41598-017-06869-7

1970s.[14] Researchers modelled how the ocean circulation process might slow and reduce efficiency of uptake beyond a certain point of warming. They warned that research shows that the gases and heat which are being circulated to the deep ocean will someday be re-circulated to the surface and partially emitted. Researchers called this "warming in the pipeline" or a "warming commitment" that is only "kicked down the road" rather than a problem solved. This concept is related to the research previously mentioned in this section that evaluates the amount of warming that will occur even if future emissions are zero. We have already seen numerous negative impacts from ocean warming, such as sea level rise and intensified storms, and even urgent global action will not be able to prevent some additional warming.

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Ocean Acidification

Ocean acidification, "the other CO_2 problem," remains a lesser-known but potentially drastic impact of climate change on the oceans. When atmospheric CO_2 is absorbed by seawater, a series of chemical reactions results in decreased pH of the water. Mean surface ocean pH decreased by 0.1 units between the 1950s and 2005, which is a 26% increase in acidity.[15] Acidification can have numerous negative impacts on ocean organisms; especially because it is currently occurring faster than it has occurred in at least 300 million years.[16] It can erode shells, alter behavior and reproduction, and change migration patterns.[17]

Scientists have long suspected that more acidic oceans will result in drops in overall biodiversity in ocean ecosystems, and researchers in Australia offered additional evidence of this possibility in 2017. They studied ecosystems which have become high-carbon due to volcanic CO_2 vents becoming more active, and compared the species composition found there with the composition in comparable ecosystems without CO_2 vents. Through a series of surveys and underwater "natural experiments," they showed that ecosystems which have become more high-carbon and acidic tend to be dominated by one or two small, aggressive fish species that researchers compared to rats or cockroaches.[18] Researchers recommended stopping overfishing and establishing protected areas as one way to combat these ecological shifts, since one of the factors driving the dominance of these less desirable species appears to be the loss of their medium-sized predators that are more commonly fished for food.

The effect of ocean acidification on organisms which use calcium carbonate is drastic. A lower pH reduces the availability of carbonate ions, which are taken up by shell-forming organisms such as coral, molluscs, and many species of phytoplankton that form the critical base of many oceanic food webs. Heat is the primary cause of coral bleaching events, but acidification likely impacts the ability of corals to recover from them. Coral reefs provide food, revenue, and protection for almost 500 million people, and their annual economic value is estimated to be US$30 billion.[19]

Ocean Deoxygenation

One of the impacts of climate change that has not received adequate public attention is ocean deoxygenation. This phenomenon receives much less attention from the public and policy-makers than warming or even acidification, but multiple factors including eutrophication from human waste and agricultural run-off and the effects of ocean warming on oxygen solubility and water stratification are interacting to enlarge existing and create new deoxygenated "dead zones." Globally, the ocean has lost 2% of its oxygen, but regionally there are losses at intermediate depths that are much higher.[20]

In 2017, researchers from Woods Hole Oceanographic Institution, Arizona State University, and Florida State University released the first tool that estimates past rates

14 Romanou, A., Marshall, J., Kelley, M., and Scott, J. 2017. Role of the ocean's AMOC in setting the uptake efficiency of transient tracers. Geophysical Research Letters. doi: 10.1002/2017gl072972.
15 Raven, J. et al. (2005) Ocean acidification due to increasing atmospheric carbon dioxide. The Royal Society Policy document 12/05, pp. 68
16 Honisch, B., et al. 2012. The geological record of ocean acidification. Science. 335(6072): 1058-1063.
17 Doney, S.C., Fabry, V.J., Feely, R.A., and Kleypas, J.A. 2009. Ocean acidification: The other CO2 problem. Annual Review of Marine Science. 1: 169-192.
18 Nagelkerken, I. Goldenger, S.U., Ferreira, C.M., Russell, B.D., and Connell, S.D. 2017. Species interactions drive fish biodiversity loss in a high-CO2 world. Current Biology DOI: 10.1016/j.cub.2017.06.023
19 Cesar, H., Burke, L., Pet-Soede, L. 2003. The Economics of Worldwide Coral Degradation. The Netherlands: Cesar Environmental Economics Consulting (CEEC), 2003.
20 Schmidtko S, Stramma L, Visbeck M. 2017. Decline in global oceanic oxygen content during the past fivedecades. Nature 542:335–39, AND Levin, LA 2018. Manifestation, drifers and emergence of open ocean deoxygenation. Annu. Rev. Mar. Sci 10: 17.1-17.32 doi. org/10.1146/annurev-marine-121916- 063359

of deoxygenation during large deoxygenation events and projects potential future losses.[21] Nuanced analysis of the rate at which deoxygenation has occurred had never been conducted. The research also draws parallels to a past great ocean anoxic event to determine if similar processes and rates are occurring now. Altogether, it represents an important step in understanding deoxygenation. The results suggest that if ocean deoxygenation spreads via similar mechanisms to past great ocean anoxic events, then the current low-oxygen area of the seafloor could double in the next 100-300 years.

Deoxygenation may have severe impacts on ocean organisms. Chronic exposure to low-oxygen (hypoxic) waters stunts organism growth, impacts reproduction, and increases vulnerability to disease.[22] Spreading hypoxic zones are likely to alter the ranges of ocean conditions that are tolerable to important fishery species, and may cause the expansion of species that thrive in hypoxic zones such as chemosynthetic bacteria and jellyfish.[23] Deoxygenated zones may also result in reduced photosynthesis in those areas, which will reduce the uptake of atmospheric CO_2 by the ocean and ocean organisms.

Conclusions

Overall, the second half of 2016 and the first half of 2017 brought a great deal of evidence that climate change is already reaching dramatic landmarks and producing significant impacts on both ocean life and the island and coastal human populations which depend on healthy oceans. It is also clear that multiple climate drivers (warming, acidification, deoxygenation) are interacting in ocean ecosystems and must be observed and remedied together. Record heat on land and sea surfaces, combined with the exceeding of the 400 ppm mark in atmospheric CO_2 concentration, confirm the progression of the global temperatures toward the milestone 1.5C of warming. In August 2017, a report by 13 United States agencies as part of a National Climate Assessment begun by President Obama brought focus to the impacts of climate change that are already being felt.[24] The report noted that Atlantic hurricanes have become wetter, likely fueled by warming sea surface temperatures; a fact that was underscored just a few

weeks after the report's release when hurricane Harvey dropped the most rainfall ever recorded in the United States. This years' news in ocean and climate science paints a picture of increased urgency for adaptation to a climate that has already changed and will continue to do so, and very rapidly. These changes have already resulted in devastating consequences for the ocean, ocean ecosystems, and human populations.

Updates on the Paris Agreement and the UNFCCC Process

The Paris Agreement entered into force on 4 November 2016. 162 of 197 Parties to the Convention have ratified as of September 2017. The forty-sixth sessions of the Subsidiary Body for Implementation (SBI 46), Subsidiary Body for Scientific and Technological Advice (SBSTA 46), and the third part of the first session of the Ad Hoc Working Group on the Paris Agreement (APA 1-3) took

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place from 8 to 18 May 2017 in Bonn, Germany.[25] Major outcomes of this meeting was the development of further guidance on the features of Nationally Determined Contributions (NDCs) under the Paris Agreement, as well as the identification of appropriate sources for the global stocktake of carbon emissions called for in Article 14 of the Paris Agreement.[26]

The May intersessional meetings also emphasized the importance of continuing engagement of the private sector and civil society, guided by the High-Level UNFCCC Global Climate Action Champions. The Champions facilitate cooperation partnerships from diverse stakeholders, reaching beyond Parties to the UNFCCC to achieve the goals of the Paris Agreement. The Global

21 Ostrander, C.M., Owens, J.D., and Nielson, S.G. Constraining the rate of ocean deoxygenation leading up to a Cretaceous Oceanic Anoxic Event (OAE-2: ~94 Ma). *Science Advances* 3(8): e1701020.
22 Lehmann, M., Schleder, D.D., Guertler, C., Perazzolo, L.M. and Vinatea, L., 2016. Hypoxia increases susceptibility of Pacific white shrimp to whitespot syndrome virus (WSSV). Arquivo Brasileiro de Medicina Veterinária e Zootecnia 68(2): 397-403. and Breitburg, D.L., Hondorp, D., Audemard, C., Carnegie, R.B., Burrell, R.B., Trice, M. and Clark, V., 2015b. Landscape-level variation in disease susceptibility related to shallow-water hypoxia. PloS one, 10(2), p.e0116223.
23 Sperling, E.A., Frieder, C.A., Levin, L.A. Biodiversity response to natural gradients of multiple stressors on continental margins. Proceeding Royal Society B. 283: 20160637.
24 Wuebbles, D., Fahey, D., and Hibbard, K. (eds.). 2017. US Global Change Research Program Climate Science Special Report (CSSR). https://www.nytimes.com/interactive/2017/08/07/climate/document-Draft-of-the-Climate-Science-Special-Report.html?mcubz=1
25 http://unfccc.int/meetings/bonn_may_2017/meeting/10076.php
26 FCCC/APA/2017/2 http://unfccc.int/resource/docs/2017/apa/eng/02.pdf

Climate Action Agenda, launched by the first two Champions (H.E. Laurence Tubiana, French Ambassador for Climate Change, and H.E. Hakima El Haite, Minister Delegate to the Minister of Energy, Mines, Water, and Environment of Morocco), has continued its work in catalyzing early implementation of the Paris Agreement. The two Climate Champions leading Global Climate Action at COP 23 in Bonn in November 2017 are H.E. Inia Seruiratu, the Fijian Minister for Agriculture, Rural and Maritime Development, and National Disaster Management, and H.E. Hakima El Haite of Morocco. The Fijian Presidency presiding over COP 23 has announced its intention to develop an Ocean Pathway Partnership under the UNFCCC; this is discussed further in the conclusions of this report.

The United States' Intention to Withdraw from the Paris Agreement

On 1 June 2017, President Donald Trump released the following statement on the United States' participation in the Paris Agreement: "In order to fulfil my solemn duty to the United States and its citizens, the US will withdraw from the Paris climate accord, but begin negotiations to re-enter either the Paris accords or a really entirely new transaction, on terms that are fair to the United States." The European Union, China, and several other signatories indicated that they will not renegotiate the deal, and will continue with the commitments of the Paris Agreement as they are written.[27] As of October 2017, no other signatory has indicated that they will withdraw.

Although the United States federal government declaring intent to pull out of the Paris Agreement represents discouraging news, since the U.S. is the world's second largest emitter and highest per capita emitter, many of the responses from Parties and the private sector to this news indicated renewed commitment to the Paris Agreement. One response to this development in 2017 is the "We Are Still In" campaign, a declaration signed by 600 US officials representing 120 million Americans and 900+ companies worth over $6.2 trillion.[28] Members of the international climate action community have been increasingly calling for engagement with the private sector to ensure CO_2 emissions reduction goals are met. Companies such as Apple, Facebook, Google, HP, Intel, Microsoft, Mars, Morgan Stanley, and Unilever declared their commitment to achieving a clean energy transition, with or without federal encouragement from the United States government.

27 Boffey, D., Connolly, K., Asthana, A. "EU to bypass Trump administration after Paris climate agreement pullout." The Guardian, 2 July 2017. Accessed 1 August 2017. https://www.theguardian.com/environment/2017/jun/02/european-leaders-vow-to-keep-fighting-global-warming-despite-us-withdrawal

28 http://www.wearestillin.com/

Ocean and Climate and the UN Sustainable Development Goals

Oceans and climate issues were strongly represented at the UN Ocean Conference to support implementation of Sustainable Development Goal (SDG) 14 (conserve and sustainably use oceans, seas, and marine resources for sustainable development), held at UN Headquarters from June 5-9, 2017. Several components of SDG 14 are relevant to the relationship between oceans and the climate, particularly Target 14.3: *Minimize and address the impacts of ocean acidification, including through enhanced scientific cooperation at all levels*. 1,395 voluntary commitments were registered at the UN Ocean Conference to support implementation of SDG 14, with approximately $25.4 billion in monetary resources pledged.[29]

236 voluntary commitments registered with the Oceans Conference (17%) were identified as relevant to SDG 14.3 (the ocean acidification goal).[30] These initiatives include a variety of proposed actions not limited to researching or combating ocean acidification. They also include emissions reduction goals, blue carbon mitigation activities, and enhancing use of coastal ecosystem in carbon capture and adaptation. In addition, over 300 voluntary commitments were identified as implementing aspects of both SDG 14 and SDG 13 (Climate Action), highlighting the synergies between oceans and climate.

51% of voluntary commitments are supporting SDG 14.2: *Sustainable management and protection of coastal ecosystems.* Initiatives related to this target utilize ecosystem-based planning, integrated coastal management, and/or marine spatial planning. These tools can be used to manage ocean ecosystems and resources while ad considering climate change mitigation and/or adaptation.

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The outcome document of the Oceans Conference, "Our ocean, our future: call for action," included a paragraph about the ocean and climate, quoted in full:

We are particularly alarmed by the adverse impacts of climate change on the ocean, including the rise in ocean temperatures, ocean and coastal acidification, deoxygenation, sea level rise, the decrease in polar ice coverage, coastal erosion and extreme weather events. We acknowledge the need to address the adverse impacts that impair

29 Vierros, Marjo. 2017. "Preliminary analysis of voluntary commitments." https://sustainabledevelopment.un.org/content/documents/16542Short_Analysis_of_Voluntary_Commitments.pdf

30 Vierros, Marjo. 2017. "Preliminary analysis of voluntary commitments." https://sustainabledevelopment.un.org/content/documents/16542Short_Analysis_of_Voluntary_Commitments.pdf

the crucial ability of the ocean to act as climate regulator, source of marine biodiversity and as key provider of food and nutrition, tourism and ecosystem services and as an engine for sustainable economic development and growth. We recognize, in this regard, the particular importance of the Paris Agreement adopted under the United Nations Framework Convention on Climate Change.[31]

This inclusion of climate change in the negotiated outcome document from the conference underscores the increasing awareness of the ocean-climate nexus. In September 2017, following the UN Oceans Conference, Secretary-General António Guterres appointed Mr. Peter Thomson, President of the 71st session of the General Assembly, as his Special Envoy for the Ocean, providing, for the first time, an ocean voice at the highest political levels of the United Nations[32] Mr. Thomson in this new role will be the coordinator of UN advocacy and public awareness efforts, as well as work to drive forward the voluntary commitments registered at the Ocean Conference. He will coordinate support for Communities of Ocean Action in collaboration with UN DESA.

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The UN released the *Sustainable Development Goals Report 2017* to review progress toward the SDGs, and the chapters on SDG 13 ("climate action") and SDG 14 ("life before water") provide relevant updates. The assessment concludes that the NDCs indicate hopeful signs that governments are integrating low-carbon sustainability into most aspects of development, and that they are appropriately shifting attention towards increased adaptation action. It urges increased consideration of disaster risk reduction in regional, national, and local climate actions; particularly through the use of ecosystem service valuation and ecosystem-based adaptation (EbA).

The SDG Report 2017 highlights the negative impacts of ocean acidification, eutrophication, and deoxygenation. The report notes that urgent action is needed to buffer the effects of acidification, as ocean acidity is expected to rise by nearly 150% before 2100.[33] Coastal eutrophication and ocean warming compound to worsen ocean

deoxygenation, which threatens urban and coastal populations relying on ocean-sourced food. The report notes little progress has occurred in any of these areas, and that at this time, the best actions available appear to be proactive adaptation and research of methods to reduce the negative effects.

Altogether, the international community has shown a renewed commitment to ocean conservation and a deeper acknowledgement of the need to consider climate change and ocean health in tandem to one another. The appointment of a Special Envoy for Oceans and the success of the Oceans Conference indicate a growing public awareness of the urgency of ocean issues in general.

Our Ocean Conference (Malta, 5-6 October 2017)

The Our Ocean Conference (which took place in 5-6 October in Malta, hosted by the EU), gathered over 400 commitments worth more than EUR 7 billion from nearly 1000 representatives of international institutions, governments, business, NGOs, foundations and research institutes from 112 countries around the world, with a view to conserve and sustainably use the oceans and their resources. Over 50 concrete commitments were made under the climate change theme, worth more than EUR 309 million. Our Ocean 2017 edition in fact was the first conference to bring private sector on board, and companies such as BNP Paribas, Carnival, Microsoft, Man etc., also presented commitments to tackle climate change.

This complements the EU's Ocean Governance Initiative, which sets out an agenda for ensuring the future of the oceans around the world. The EU's Joint Communication on international ocean governance, for safe, secure, clean and sustainably managed oceans, proposed 50 actions on 1) improving the international ocean governance framework; 2) reducing human pressure on the oceans and creating the conditions for a sustainable blue economy 3) strengthening international ocean research and data.

Strengthening international cooperation and action on climate change is therefore a central cornerstone in the EU's ocean governance agenda. Actions aim to support the implementation of the Paris Agreement and miti-

31 A/Res/71/312. http://www.un.org/ga/search/view_doc.asp?symbol=A/RES/71/312&Lang=E
32 "Secretary-General Appoints Peter Thomson of Fiji Special Envoy for Ocean." 12 September 2017. SG/A/1758-BIO/5010-SEA/2061. https://www.un.org/press/en/2017/sga1758.doc.htm
33 https://unstats.un.org/sdgs/files/report/2017/TheSustainableDevelopmentGoalsReport2017.pdf

gate the harmful impact of climate change on oceans, coastlines and ecosystems. For example, the EU has just dedicated EUR 1,500.000 under the European Maritime and Fisheries Fund (EMFF) to support the restoration of damaged or degraded coastal and marine ecosystems in the Mediterranean as part of larger initiative to support the Blue Economy.

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Oceans and the Law of the Sea

The UN Secretary-General's March 2017 report on "Oceans and the law of the sea"[34] reported especially on the findings of the First Global Integrated Marine Assessment and the Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report, emphasizing the importance of oceans in climate change and the impact of climate change on the oceans. It reiterated the importance of investing in ocean resilience now, as it becomes increasingly clear that some damage from climate change is unavoidable and may be irreversible. It pointed out that even international processes not directly related to climate change, such as the International Legally Binding Instrument on Biodiversity Beyond National Jurisdiction (BBNJ ILBI) currently being negotiated under the UN Convention on the Law of the Sea (UNCLOS), should be crafted with resilience to climate change in mind.

The 18th Meeting of the UN Open-Ended Informal Consultative Process on Oceans and the Law of the Sea (ICP-18) took place in May 2017, and with a central focus on "The effects of climate change on oceans."[35] This was the first time that oceans and climate change have been considered together under any General Assembly process. Delegates centrally addressed the central role of oceans in climate and the strength of the relationship between climate and oceans was well underscored. Delegates noted the increasing impacts of climate change on vulnerable groups in particular, and stressed the need to place increased focus and funding towards adaptation. Many delegates expressed concern for or solidarity with SIDS.

During the discussions at ICP-18, Venezuela, Fiji, and Tonga suggested an UN General Assembly Sixth Committee agenda item to discuss the possible impacts of sea level rise on state sovereignty and maritime boundaries.[36] Changes to Exclusive Economic Zones (EEZs) could potentially be disputed as coastlines change over time, and delegates expressed the desire to proactively address this possibility in a manner that protects sovereignty. UNCLOS is also the appropriate forum to discuss potential legally binding instruments that could address the effects of climate change in areas beyond national jurisdiction (ABNJ), and several delegates noted that more could be done in this area in addition to the continued work of the BBNJ Preparatory Committee. Other priorities highlighted by the delegates included increased coordination of ocean observation systems, ramped-up funding for research on ocean acidification, the valuation and more ambitious protection for coral reefs and other important coastal habitats, the establishment of more marine protected areas managed using ecosystem-based adaptation, the need for North-South and South-South collaboration, and the urgency of meeting the mitigation goals of the Paris Agreement.

Through preparations for a BBNJ ILBI and the discussions at ICP-18, the UNCLOS process centrally emphasized the importance of the relationship between oceans and climate this year. The ENB noted in their report on the ICP-18 that UNCLOS has a dispute settlement mechanism that can be used to address the legal implications of climate change impacts. The discussions at ICP-18 consistently emphasized the importance of inter-agency cooperation and the full utilization of all resources to meet mitigation goals, increase ocean monitoring and research, and proactively prepare for issues such as climate refugees and maritime legal issues.[37]

3. The Central Role of Nationally Determined Contributions

Nationally Determined Contributions (NDCs) are pledges created by nations prior to the Paris Agreement which outline the national government's plans to address mitigation and adaptation aspects of climate policy. The use of NDCs marked an important change in the UNFCCC process. Prior to the Paris Agreement, only Annex I[38] nations were asked to commit to reducing

34 Oceans and the Law of the Sea: Report of the Secretary-General. UNGA A/72/70. http://undocs.org/A/72/70

35 Earth Negotiations Bulletin. Summary of the Eighteenth Meeting of the United Nations Open-Ended Informal Consultative Process on Oceans and the Law of the Sea. New York: 22 May 2017. http://enb.iisd.org/vol25/enb25130e.html

36 Earth Negotiations Bulletin. Summary of the Eighteenth Meeting of the United Nations Open-Ended Informal Consultative Process on Oceans and the Law of the Sea. New York: 22 May 2017. http://enb.iisd.org/vol25/enb25130e.html

37 Earth Negotiations Bulletin. Summary of the Eighteenth Meeting of the United Nations Open-Ended Informal Consultative Process on Oceans and the Law of the Sea. New York: 22 May 2017. http://enb.iisd.org/vol25/enb25130e.html

38 "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

emissions; in NDCs, all nations submit their commitment to reduce emissions. Because the NDCs are produced by national governments rather than negotiated on the international level, they provide a window into the priorities of particular governments with respect to their national policies. NDCs are now an important resource in understanding the level of ambition that exists on the national level, as well as a way to assess consideration of specific issues such as impacts of climate change on oceans and coasts. It is important to remember that NDCs are not the only indication of a nation's priorities in climate policy; some nations that did not address oceans in their NDCs have been quite active in ocean and climate policy spheres.

An analysis by Gallo *et al.* at Scripps Institution of Oceanography, published shortly before UNFCCC COP 23, evaluated the presence of marine issues in the climate policy priorities outlined in NDCs.[39] Researchers found that 70% of the NDCs include some mention of oceans and coasts. 21% of NDCs did not address the ocean or coasts and were created by nations that are land-locked, and 9% of nations were coastal but did not mention marine issues. Many nations in the latter category were Annex I members of the UNFCCC (e.g. the United States, Australia, Norway, the European Union, etc.), and many have large Exclusive Economic Zones. Most nations which discussed marine issues focused on impacts and adaptation (92%), while only 52% of nations that mentioned oceans discussed marine mitigation topics. NDC analysis revealed that Parties are not always discussing the issues that are the most concerning to scientists; only 14 of 112 NDCs mentioned ocean acidification, and only Mauritania addressed ocean deoxygenation in its NDC.

Scripps researchers developed a Marine Focus Factor (MFF) to quantify the inclusion of marine issues in NDCs. The MFF uses the frequency and diversity of marine topics mentioned in each NDC; a higher MFF indicates that ocean issues are mentioned frequently, and across a broad variety of topics. Gallo *et al.* found that coastal nations had significantly higher MFFs than land-locked countries, Annex I Parties had significantly lower MFFs than non-Annex I Parties, and the majority of the NDCs with the highest MFF were Small Island Developing States (SIDS). The three factors which positively influence MFF most strongly were a high percentage of the population living below 5 m above sea level, the nation being classified as SIDS, and the percentage of land area below 5 m above sea level. It is not surprising that NDCs of SIDS have the most comprehensive inclusion of marine issues in their NDCs on average; SIDS have long been vocal stakeholders in ocean and climate policy.

39 Gallo, N.D., Victor, D.G., and Levin, L.A. 2017. Ocean commitments under the Paris Agreement. Nature Climate Change. DOI: 10.1038/NCLIMATE3422

NDCs are now in the implementation phase. UNFCCC COP 22 was the "COP of action," meant to take the ambitious goals drawn up in the Paris Agreement and associated NDCs and jump-start their realization. Adequate financial and in-kind support of the NDCs of developing nations, particularly SIDS and developing coastal nations, must be made available if they are to be fully implemented. Two of the reports in preparation by ROCA will address this issue; a report on NDCs, and a finance tracking report. The former report will review SIDS NDCs to estimate what is needed from the international community to support their realization, and the latter will analyze flows of climate finance towards marine issues in general. Table 1 provides a preview of this work by providing an overview of the inclusion of marine issues in the SIDS with the highest MFF in Gallo *et al.*

There are many commonalities in the SIDS NDCs featured in Table 1. Each NDCs includes thoroughly prepared plans for building the resilience of their coastal and ocean ecosystems and populations, and each mentions that their adaptation efforts have a great deal more urgency than their mitigation efforts. Effective implementation of NDCs in LDCs and SIDS will require billions of dollars in international financial support, and a great deal of ambitious capacity development projects. Most of the SIDS noted in Table 1 already benefit from at least one international financing project, through the GCF, various development banks, or other partnerships. All of the SIDS noted in Table 1 indicated in their NDCs that their current financial resources are not sufficient. In many cases, a thorough assessment of financial, in-kind, and technology needs is still necessary. ROCA partners will provide a more thorough analysis of what is needed to support the implementation of SIDS NDCs in their planned NDC report.

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NDCs will be revised and strengthened in the coming years; the Paris Agreement calls for successive contributions, with each new NDC reaching the highest possible ambition for that Party. Parties should have access to the best possible science regarding the impacts of climate

Table 1. Overview of marine issues in SIDS NDCs with the ten highest Marine Focus Factors (MFF) in Gallo et al.[1] For each Party to following information is shown: the MFF score, its region, the most commonly mentioned marine issues featured in the Party's NDC, financial needs if they are given, and a brief outline of additional capacity support needed from the international community to meet goals.[2] The "Needed Capacity" column is limited to items where the Party explicitly mentioned support from the international community, and the last column notes illustrative examples of existing financing.

1 Gallo, N.D., Victor, D.G., and Levin, L.A. 2017. Ocean commitments under the Paris Agreement. *Nature Climate Change.* DOI: 10.1038/NCLIMATE3422

2 NDC Interim Registry. http://www4.unfccc.int/ndcregistry/Pages/Home.aspx

Party	MFF	Region	Featured Marine Issues	Financing Needed (USD)	Needed Capacity	Existing Int'l Financing or Capacity Building Projects
Maldives	23.2	Africa/ Indian Ocean	Ocean warming, coral reefs, sea level rise, tourism	Not specified	Establishment of national climate resilience funds, desalinization tech, development and implementation of NAP, building national resilience to SLR and other impacts, technologies to address impacts	GCF/UNDP water shortage alleviation project
Saint Kitts and Nevis	18.8	Caribbean	Ocean warming, mangroves, sea level rise, tourism	Not specified	Technical training, workshops, feasibility and technical studies	AFD and CDB Climate Adaptation funds
Kiribati	17.9	Pacific	Ocean warming, acidification, mangroves, coral reefs, blue carbon, sea level rise	~$80 million	More direct access to adaptation financing, technology, capacity building workshops and training	*Kiribati Joint Implementation Plan* *Word Bank Kiribati Adaptation Project III* GCF and GEF projects in development
Bahrain	17.8	Africa/ Indian Ocean	Ocean warming, mangroves, blue carbon	Not specified	Finance, technology transfer (particularly desalinization), building capacity for conservation of blue carbon ecosystems	
Seychelles	15.4	Africa/ Indian Ocean	Ocean warming, acidification, mangroves, blue carbon, sea level rise, fisheries, tourism	~$309 million (mitigation efforts) ~$295 million (adaptation efforts)	Research on potential impacts, training and STEM expertise, monitoring capacity,	Three EbA projects with GEF Adaptation Fund, UNEP, and Gov of China Water security loans from EIB, AfDB Sustainable fisheries projects with AfDB, Gov of Japan Two GEF solar grid projects Disaster preparedness funds from EU Islands Project
Mauritius	15.3	Africa/ Indian Ocean	Ocean warming, mangroves, coral reefs, sea level rise, fisheries	~$1.5 billion (mitigation efforts) ~$4 billion (adaptation efforts)	Streamlined access to funds, technology transfer, capacity building training and workshops	GCF and co-financers renewable energy project
Saint Vincent and the Grenadines	14.8	Atlantic	Ocean warming, mangroves, coral reefs, sea level rise, tourism	$20 million (for disaster reduction effort only)	Technology transfer, capacity building to reduce emissions, support for development of a national mitigation action in transport	*Pilot Program for Climate Resilience (PPCR)* with the World Bank Group Climate Investment Funds
Nauru	14.2	Pacific	Ocean warming, acidification, coral reefs, sea level rise	$55 million (mitigation efforts)	Technology for energy transition and adaptation efforts, a technology needs assessment, education and training, infrastructure investment	GCF sustainable infrastructure project
Bahamas	13.9	Caribbean	Ocean warming, mangroves, blue carbon, tourism	Not specified	Technical expertise	
Dominica	13.4	Caribbean	Ocean warming, acidification, coral reefs, blue carbon, sea level rise	$99 million (mitigation efforts) $25 million (adaptation efforts)	Technology development and transfer, support for energy independence, building disaster risk preparedness (warning systems, shelters, training)	*Pilot Program for Climate Resilience (PPCR)* with the World Bank Group Climate Investment Funds AFD and CDB Climate Adaptation funds

change on their ecosystems and communities, so that they can accurately gauge the risks and work that needs to be done. Most of the SIDS featured in Table 1 explicitly discussed the value of their Blue Carbon ecosystems for both mitigation and adaptation benefits; one of the key steps in supporting the development of their next NDCs could be a global Blue Carbon stocktake. Overall, NDCs represent an opportunity for the international community to understand what is needed to achieve a climate resilient future; the rest of this report focuses on the actions being taken to create that future.

All of the SIDS noted in Table 1 (p.12) indicated in their NDCs that their current financial resources are not sufficient. In many cases, a thorough assessment of financial, in-kind, and technology needs is still necessary. ROCA partners will provide a more thorough analysis of what is needed to support the implementation of SIDS NDCs in their planned NDC report.

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4. Mitigation

Roadmap Recommendation: Further develop and apply mitigation measures using the oceans, such as implementing "Blue Carbon" policies, reducing CO_2 emissions from ships, developing ocean-based renewable energy, and considering (long-term/no-harm) ocean-based carbon capture and storage. Encourage all nations to reduce CO_2 emissions so that the Paris Agreement to limit emissions to well below 2°C can be achieved, ideally holding to 1.5°C.

Items in this section and subsequent sections are organized by their relevance to the sub-recommendations of that section. Each section has an over-arching Roadmap Recommendations; general developments related to the UNFCCC process and the Paris Agreement are organized under the general recommendation in each section. With respect to mitigation, the major development within the UNFCCC process in the past year was the continuing development of guidance and support for the implementation of NDCs at the May 2017 intersessional climate meetings in Bonn.[40]

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

Blue Carbon as an integrated strategy for both climate change mitigation and coastal management was widely featured in the voluntary commitments, discussions, and outcomes of the UN Oceans Conference and Our Oceans Conference 2017. It has received increasing attention and investment from ocean policy communities as well as climate change policy communities. The Blue Carbon Code of Conduct, a voluntary commitment registered at the Ocean Conference, brought together over 40 NGOs, 47 members of the scientific community, and UNEP to endorse a sustainable, socially just, and accountable code of conduct for the conservation of coastal marine environments. [41]

The international Blue Carbon Initiative (BCI), led by Conservation International, IOC-UNESCO, and IUCN, is a leader in developing and supporting the implementation of coastal blue carbon policies. BCI's activities in 2016-2017 are highlighted in detail in the companion OCIA report; details about this report are alluded to in the introduction to this report. This program promotes awareness of the ability of coastal ecosystems to act as effective carbon sinks, among their other values, and works to create inventories of blue carbon.42 The Global Mangrove Alliance, a partnership between Conservation International, The Nature Conservancy, the World Wildlife Fund, IUCN, Wetlands International and Rare launched its commitment to increase mangrove habitat area by 20% before 2030 at the UN Oceans Conference.[43]

Additional scientific studies on Blue Carbon are being carried globally to inform the policy processes, in particular the discussions on technical considerations to the

40 http://unfccc.int/meetings/bonn_may_2017/meeting/10076.php
41 https://oceanconference.un.org/commitments/?id=20420
42 http://thebluecarboninitiative.org/
43 https://oceanconference.un.org/commitments/?id=14787

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2013 IPCC Wetlands Supplement taking place in May 2018. Recently, a group of Japanese scientists revealed the mechanisms of how CO_2 is transmitted and stored by eel grass in the coastal areas within the Tokyo Bay. Eel grass beds are an effective carbon sink and provides multiple services and benefits in coastal areas, such as improving water quality. In Bizen City in Okayama Prefecture in Japan, after a drastic decrease of seagrass bed in 1970s, the seagrass bed was restored from 12 ha to 250 ha in recent years through joint efforts led by a charismatic leader of a fisheries cooperative, supported by the academia, local NGOs and junior high school students.[44] The Ocean Policy Research Institute of the Sasakawa Peace Foundation has been supporting Bizen City in promoting integrated coastal management and multi-stakeholder dialogue to enhance and sustain these activities.

The International Coral Reef Initiative (ICRI), a partnership among governments, international organizations, and non-government organizations, launched a grant program in 2017 as part of the voluntary commitment they announced at the Oceans Conference in June 2017.[45] This commitment, "The ICRI Plan of Action 2016-2018," promotes awareness of the importance to coral reefs across multiple themes, including climate change mitigation and fisheries resilience. The grant program will specifically benefit projects to restore and protect coral reefs, and at least one mangrove project.

UNDP/GEF announced a commitment to "Multi-stakeholder efforts to enhance socio-ecological landscape resilience in Pakistan's Indus Delta area" during the Oceans Conference as part of their Small Grants Program Pakistan.[46] As of the end of September 2017, this project reports 7000 acres of mangroves conserved through either reforestation or related activities in the Indus Delta. The project also announced the training of 240 Master Trainers on mangrove plantation conservation.

Although non-state actors have been the driving force in researching and promoting blue carbon, national governments also increased ambition in this area in 2017. Australia's initiative to strengthen blue carbon research and utilization as a mitigation tool in the Indian Ocean region was launched this year.[47] The Republic of Korea is developing a National Information System on Blue Carbon and has pioneered the use of algae as a mitigation tool.[48]

At the 2017 Our Ocean Conference in Malta, Australia announced a series of initiatives within the International Partnership for Blue Carbon, including a workshop in the Philippines in August 2017 helping the Coral Triangle countries (Philippines, Malaysia, Indonesia, Solomon Islands, Timor Leste, PNG) identify needs and opportunities to develop tools supporting knowledge sharing. In addition, Australia is hosting visiting fellows from IORA countries (Madagascar, Mauritius and Seychelles) in November 2017 and supporting a proposed IORA summit in 2018. In addition, Australia announced EUR 300,000 (AUD 447,000) for a series of events to foster greater blue carbon awareness and cooperation in the Indian Ocean region. As a first step, Australia will hold a symposium in 2018 to develop a common understanding of blue carbon and a framework for future priorities in the Indian Ocean region.

Moreover, Indonesia announced the establishment of a national blue carbon program to support the establishment of the scientific, institutional and community engagement foundation necessary for Indonesia to benefit from future Blue Carbon finance opportunities, as well as alternative livelihood for coastal communities in its coastal mangrove and sea grass ecosystems. It will include the establishment of a Regional-International Center on Blue Carbon, expanding science-policy program, conservation and management, assessment of Blue Carbon value, mangrove & seagrass ecosystem restoration, capacity building in sustainable fisheries, tourism and alternative livelihoods.

Finally, the United Kingdom announced EUR 11.4 million (GBP 10.1 million) between 2016 and 2023 to design and introduce a model of sustainable development for mangrove habitats. The project will focus on

44 Integrated Coastal Management (ICM)in Bizen City, Okayama Prefecture. https://www.spf.org/opri/projects/icm/okayama/
45 https://oceanconference.un.org/commitments/?id=16778
46 https://oceanconference.un.org/commitments/?id=19371
47 https://oceanconference.un.org/commitments/?id=19028
48 Chung, I.K. and Oak, J.H. 2013. Installing kelp forests/seaweed beds for mitigation and adaptation against global warming: Korean Project Overview DOI: 10.1093/icesjms/fss206; Earth Negotiations Bulletin. Summary of the Eighteenth Meeting of the United Nations Open-Ended Informal Consultative Process on Oceans and the Law of the Sea. New York: 22 May 2017. http://enb.iisd.org/vol25/enb25130e.html

blue carbon sequestration and forestry management, fisheries management and improvement, mangrove livelihood diversification, community health and women's empowerment.

Further accelerate progress in addressing air emissions from ships

The International Maritime Organization (IMO), the primary regulatory entity for international shipping, drafted a strategy for reduced GHG emissions from ships in June 2017 through their Marine Environment Protection Committee (MPEC) and decided to adopt a comprehensive strategy by 2023.[49] They also adopted guidelines to ramp up energy efficiency on existing ships. Energy efficiency measures have been mandatory for ships since MARPOL Annex VI in 2013, but the new guidelines are more ambitious. They increase ability to keep track of ship fuel oil consumption data by developing an IMO Ship Fuel Oil Consumption Database, and establish a group to review the Energy Efficiency Design Index (EEDI).

At the Our Ocean conference, the EU announced a project together with IMO worth EUR 10 million concerning climate change mitigation in the maritime shipping sector. The project aims to establish five Maritime Technology Cooperation Centres (MTCCs), one in each of the target regions – Africa, Asia, the Caribbean, Latin America and the Pacific, forming a global network. The network is to enable developing countries in these regions to develop energy-efficiency measures in maritime transport.

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

Many international collaborations to ramp up ambition on ocean-based mitigation tools were announced at the UN Ocean Conference and elsewhere during the year. Swimsol GmbH is working to build floating solar energy farms as part of SIDS blue economies.[50] The World Team project Sustainable Solutions, Oceans Opportunities and Small Island States (SOS-IS) announced its mission to build renewable energy independence of SIDS, promote technology transfer, ocean cleanup, sustainable transportation, MPA expansion, and scientific research.[51]

The offshore wind sector grew this year, particularly because the price of energy generated by offshore wind has dropped by over a third since 2012. Scotland tested the world's first floating wind farm.52 The EU added 6.1 GW of offshore wind capacity in the first six months of 2017, with the majority of new developments taking place in Germany.[53]

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The International Renewable Energy Agency (IRENA), an intergovernmental organization supporting national transitions to sustainable energy, has made progress on several ongoing initiatives. The IRENA SIDS Lighthouses initiative promotes the development of all forms of renewable energy in SIDS and includes a specific goal of assisting with the deployment of numerous ocean energy projects before 2020. To support the dissemination of knowledge covering ocean energy, IRENA published a report covering *Ocean Energy: Technologies, Patents, Deployment Status and Outlook,* in turn supported by a series of technology briefs covering generation from tidal, wave, ocean thermal energy conversion (OTEC) and salinity gradient energy.[54] IRENA's report on *Renewable Energy Opportunities for Island Tourism* gives a case study detailing the use of cold deep ocean water for renewable seawater air conditioning.[55]

At Our Ocean conference in Malta, the European Union announced that it will finance the testing of the first wave and tidal array deployments in Europe in 2017 by contributing EUR 1.5 million to support administrations and project developers involved in environmental monitoring.

Furthermore, the Port of Civitavecchia announced its commitment to provide 50% of land energy need by 2023 though the utilisation of Oscillating Water Column (OWC) energy converters. In 2018, the port will put in place the first OWC and by 2020 the first prototype of an OWC energy converter derivate from mini-hydroelectric technology (WaveSax). This is

49 http://sdg.iisd.org/news/imo-environment-committee-advances-work-on-shipping-emissions/
50 http://swimsol.com/
51 https://oceanconference.un.org/commitments/?id=21714
52 Harrabin, Roger. "World's first floating wind farm emerges off coast of Scotland." BBC. 23 July 2017. Accessed 1 August 2017. http://www.bbc.com/news/business-40699979
53 Climate Action Programme. "Europe added 6.1 GW of wind power in the first half of 2017." Climate Action UNEP. 31 July 2017. Accessed 1 August 2017. http://www.climateactionprogramme.org/news/europe-added-6.1gw-of-wind-power-in-the-first-half-of-2017
54 http://www.irena.org/menu/index.aspx?mnu=Subcat&PriMenuID=36&CatID=141&SubcatID=445
55 http://www.irena.org/menu/index.aspx?mnu=Subcat&PriMenuID=36&CatID=141&SubcatID=444

designed to be installed in the marine side of a dock, being a small and modular device, with an integrated system of protection from extreme events. The total capital expenditure of this development represents EUR 12,5 million. Moreover, Resolute Marine Energy announced the launch of its first Wave2OTM system in Cape Verde in the framework of which it will train between 5 and 10 local workers and provide state-of-the-art marine survey equipment valued at approximately EUR 208,000 (USD 250,000) to INDP, the Cape Verde fisheries institute, by the 4th quarter of 2019.

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

Carbon capture and storage remains under review by the scientific community. When the ocean removes CO_2 from the atmosphere, it is initially found in the water in the form of carbonic acid. When the more acidic ocean water circulates to the ocean floor, one process which neutralizes the acid is its reaction with the calcium carbonate shells that cover the sea floor. The circulation process itself takes tens of thousands of years, and the neutralization reaction itself is slow. Researchers in 2017 identified the slowest step in this reaction as well as an enzyme found in animal blood that speeds it up.[56] The ability to speed up the reaction has implications for potential artificial recreation of this natural process in a sustainable manner. This is the same reaction that results in the dissolution of living corals' and other marine animals' calcium carbonate exoskeletons, so the mapping of this reaction also has implications for understanding the impact of acidification on these organisms.

A handful of studies were published in 2016 and 2017 on the potential effects of long term carbon capture storage (CCS) in the ocean and/or seabed and the feasibility of such projects in the near term.[57] A research group from Scotland has proposed and tested the possibility of using microbes with the ability to assimilate CO_2 as leak containers for seabed CCS projects.[58] Much research is needed to ensure that marine CCS can be conducted safely, and this research needs to be adequately translated into workable policy.

56 Subhas, A., et al. 2017. Catalysis and chemical mechanisms of calcite dissolution in seawater. Proceedings of the National Academy of Sciences. DOI: 10.1073/pnas.1703604114

57 Underschultz, Jim, Dodds, Kevin, Michael, Karsten , Sharma, Sandeep , Wall, Terry and Whittaker, Steve (2017). Carbon capture and storage. In Sheila Devasahayam, Kim Dowling and Manoj K. Mahapatra (Ed.), Sustainability in the mineral and energy sectors (pp. 437-452) Boca Raton, FL, United States: Taylor & Francis Group. doi:10.1201/9781315369853-24

58 Hicks, N., Vik., U., Taylor, P., Ladoukakis, E., Park, J., Kolisis, F., and Jakobsen, K. (2017). Using prokaryotes for carbon capture storage. Trends in Biotechnology. 35(1): 22-32. https://doi.org/10.1016/j.tibtech.2016.06.011

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.

Adaptation issues continue to gain increased awareness and attention in the UNFCCC process. The Adaptation Committee, established by the UNFCCC under the Cancun Adaptation Framework, held its 10th meeting in September 2016 and its 11th meeting in March 2017. The Committee was reviewed by the UNFCCC COP at COP 22. The review noted that although the Adaptation Committee has been excellent in its collaboration with other UNFCCC entities, such as the Nairobi Work Programme and the LDC Expert Group, but lamented the shortfall of monetary and in-kind resources for the Committee.[59]

The UNFCCC Nairobi Work Programme released a report, "Adaptation planning, implementation, and evaluation addressing ecosystems and areas such as water resources," which reconfirms the link between healthy ecosystems and capacity for resilience to climate change, as well as providing evidence that ecosystem-based solutions are more cost effective.

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

59 FCCC/CP/2016/10/Add.1 . http://unfccc.int/resource/docs/2016/cop22/eng/10a01.pdf

Significant funding for ocean adaptation was announced in various contexts this year. New Zealand has ramped up adaptation ambition through the Pacific Partnership on Ocean Acidification, allocating $NZ 2.1 million to adaptation and capacity building to address effects of ocean acidification.60 The World Bank Group's Adaptation Fund began a $9 million program in the Federated States of Micronesia in 2017, with the goal to build national and local resilience to coastal erosion and flood-related climate risks.61 The five-year project is intended to increase understanding of the kinds of adaptation measures that work for island communities and build local-scale governance and knowledge.

The European Union supports adaptation by supporting programs on coastal biodiversity and ecosystems protection with significant climate change impacts in the Latin America, Caribbean and in the West Africa Regions with currently about EUR 25 million and another EUR 28.5 million pledged for 2017-2020. Furthermore, EUR 215 million already go to projects in the fisheries sector, with about EUR 40 million in Eastern Africa-Southern Africa and Indian Ocean, EUR 50 million in Western Africa and EUR 45 million in the Pacific. An additional EUR 70 million are pledged for the fisheries sector for 2017-2020.

The United Nations Office for Disaster Risk Reduction (UNISDR) continues to promote the use of the Sendai Framework for Disaster Risk Reduction: 2015-2030, underlining the importance of disaster risk preparedness and management, particularly through ecosystem and natural resource management. UNISDR published a handbook titled *How to Make Cities More Resilient: A Handbook for Local Government Leaders* in 2017 as part of its "My city is getting ready!" campaign.[62] The handbook has a particular focus on coastal cities, since these cities have an additional layer of risk due to their exposure to sea level rise and coastal storms. The local lens of the handbook is useful and follows the adaptation recommendation that adaptation support be geared toward local leaders. The handbook also meets the EbA aspect of the Roadmap's adaptation recommendations by highlighting EbA examples such as mangrove-planting projects in Vietnam.

A national-level example of an integrated coastal zone management plan reporting successful implementation comes from Belize in 2016 and 2017.[63] Researchers from the national Coastal Zone Management Authority and Institute developed a plan that utilized marine spatial planning, solicited the input of a wide range of stakeholders across sectors, and accounted for the flow of capital benefits from nature to human communities. The value of ecosystems services such as storm surge protection from coastal ecosystems and tourism benefits from healthy corals was appropriately accounted for. The plan was hailed as visionary by UNESCO, and it provides an excellent model for utilizing these tools.

FAO and partners have been working to identify climate change implications, vulnerabilities and context-specific adaptation and disaster risk management strategies to improve the resilience of vulnerable aquatic ecosystems and their dependent communities, and that provide shoreline and riverine protection, food and nutrition security, maintenance of water quality, income and livelihoods services. Support for understanding vulnerabilities specific to the fisheries and aquaculture sector include a global expert workshop to climate change vulnerability assessment (VA) methodologies in fisheries and aquaculture from which a technical report on VA methodologies has been published. National and local scale VA have been supported in Kenya, in Peru and in the Benguela region to guide adaptation planning.

Moreover, in support of the National Adaptation Plan (NAP) process and as a complement to the technical guidelines issued by the Least Developed Countries Expert Group (LEG) of the UNFCCC to provide advice to national planning processes, identify and address capacity gaps, prepare national adaptation plans, and establish a monitoring and evaluation system, FAO is developing supplementary guidelines specifically for fisheries and aquaculture.

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

NGOs have been important in furthering the use of EbA approaches. The IUCN is particularly active in implementing EbA projects. They currently have 45 active projects in 58 countries. Conservation International (CI) has been tracking the development of EbA policy in the last several years, and observed a shift from a general consideration and setting of guidelines in 2009-2012 towards a balance between implementation and consideration in 2015. They observed that while regional networks on EbA policies have grown significantly in the past decade, there is still a need for explicit criteria and cohesive standards.[64] CI has also conducted several

60 https://oceanconference.un.org/commitments/?id=15798

61 https://www.adaptation-fund.org/project/enhancing-climate-change-resilience-vulnerable-island-communities-federated-states-micronesia/

62 http://www.unisdr.org/campaign/resilientcities/assets/documents/guidelines/Handbook%20for%20local%20government%20leaders%20[2017%20Edition].pdf

63 Verutes, G.M., Arkema, K.K., Clarke-Samuels, C., Wood, S.A., Rosenthal, A., Rosado, S., Canto, M., Bood, N., and Ruckelshaus, M. 2017. Integrated planning that safeguards ecosystems and balances multiple objectives in coastal Belize. International Journal of Biodiversity Science, Ecosystem Services and Management. DOI: 10.1080/21513732.2017.1345979

64 Hills, Terry. (2015). The state of ecosystem-based adaptation (Eba)

pilot projects on EbA in South Africa, the Philippines, Brazil, and the Caribbean.

A new 2017 study by University of Miami researchers in the Caribbean showed that current restoration efforts known as "coral gardening" are effective in recovering lost reefs.[65] Coral gardening involves divers propagating new corals underwater in protected areas. Now that sufficient time has passed since these efforts began, researchers are noting that these gardened corals have similar productivity and healthiness indicators as wild corals. This is hopeful for climate change adaptation, since restoring and maintaining reefs provides defense against storm surges as well as supporting overall healthy ocean ecosystems.

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

At the 2017 Our Ocean conference, participants announced the creation of new marine protected areas spanning more than 2.5 million km², or more than half the size of the entire European Union. 17 NDCs mentioned the creation of new MPAs as part of their marine adaptation actions, and 24 NDCs mentioned the use of ecosystem-based management techniques.[66] The UN Sustainable Development Goals 2017 report noted that the extent of marine protected areas (MPAs) has increased from 1.7% of global marine areas in 2001 to 5.3%

17 NDCs mentioned the creation of new MPAs as part of their marine adaptation actions, and 24 NDCs mentioned the use of ecosystem-based management techniques. (Gallo, et al, 2017)

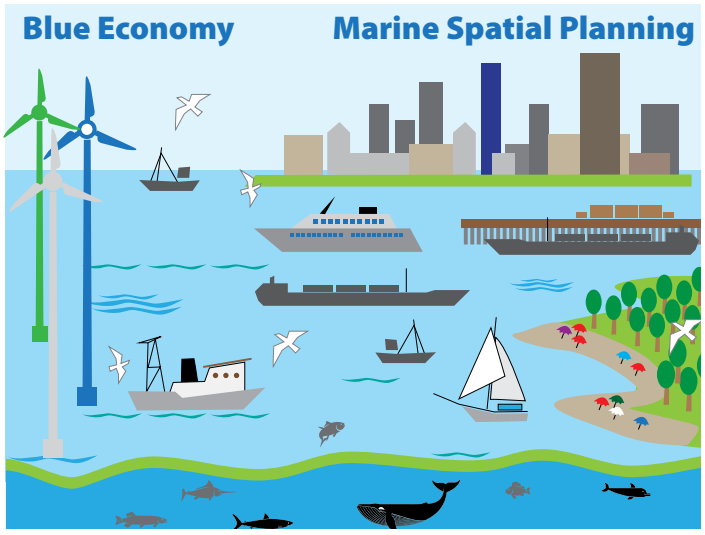
in 2017. Although this is progress, the rate of increase falls short of the goal of reaching 10% by 2020. While 13.2% of areas within national jurisdiction are conserved, only 0.25% of areas beyond national jurisdiction (ABNJ) are protected. Conservation of marine areas can increase resilience of ocean ecosystems to the effects of climate change, since over-fishing, pollution, and other factors can compound those effects.

to climate change in 2015: synthesis report. Conservation International. 28 July 2015. Accessed 3 August 2017. http://www.conservation.org/publications/Documents/EbA-Synthesis-28-July-2015.pdf

65 Schopmeyer, S.A., Lirman, D., Bartels, E., Gilliam, D.S., Goergen, E.A., et al. 2017. Regional restoration benchmarks for Acropora cervicornis. Coral Reefs. DOI: 10.1007/s00338-017-1596-3

66 Gallo, N.D., Victor, D.G., and Levin, L.A. 2017. Ocean commitments under the Paris Agreement. Nature Climate Change. DOI: 10.1038/NCLIMATE3422

6. Blue Economy



Roadmap Recommendation: Promote and apply Blue Economy approaches with emphasis on low-carbon solutions and economic benefits to developing countries and SIDS (following SDG target 14.7)

2017 has seen increased awareness and support of Blue Economy as a sustainable low-carbon economic growth concept. The term originated around the time of the Rio+20 Conference in 2012. Some have used it to refer to the use of the ocean and its resources for sustainable economic development, and others use it to refer to ocean industry and activity regardless of sustainability. Numerous definitions of Blue Economy and ocean economy have been proposed; for example, 14 countries have used 14 different definitions of ocean economy in recent years.[67] Commonalities in the definitions do exist, and a reasonable synthesis definition of ocean economy is all economic activity occurring in the ocean, or giving inputs and/or receiving outputs from the ocean. Therefore, the ocean economy refers to any and all industries that utilize ocean resources, from offshore oil exploration to fisheries to cruise tourism. In 2017, the ocean and climate community sought to define Blue Economy as a low-carbon economy concept distinct from ocean economy.

A 2017 report published by the World Bank and the United Nations Department of Economic and Social Affairs emphasizes that the Blue Economy aims to move beyond business as usual to consider economic development and ocean health as compatible propositions. Thus, while a mix of economic activities may contribute to a Blue Economy, these activities need to (i) provide

67 The Economist Intelligence Unit. "The blue economy: growth, opportunity, and a sustainable ocean economy. An Economist Intelligence Unit briefing paper for the World Ocean Summit 2015." https://www.eiuperspectives.economist.com/sites/default/files/images/Blue%20Economy_briefing%20paper_WOS2015.pdf

social and economic benefits for current and future generations; (ii) restore, protect, and maintain the diversity, productivity, resilience, core functions, and intrinsic value of marine ecosystems; and (iii) be based on clean technologies, renewable energy, and circular material flows that will reduce waste and promote recycling of materials. The report states that the Blue Economy is understood as comprising the range of economic sectors and related policies that together determine whether the use of oceanic resources is sustainable.[68] The development of a Blue Economy is described by the Economist Intelligence Unit in a 2015 report: "A sustainable (blue) ocean economy emerges when economic activity is in balance with the long-term capacity of ocean ecosystems to support this activity and remain resilient and healthy."[69]

The ocean is the next great economic frontier, with numerous ocean-based industries growing by many orders of magnitude in the recent past and near future. Offshore wind, offshore aquaculture, seabed mining, and marine genetic biotechnology were practically nonexistent twenty years ago and are now growing into prominence as the relevant technology becomes available. Industries which are already established, such as seaborne trade and tourism, have the potential to grow 3 to 4% annually over the coming decades.[70] Policymakers must consider the long-term health of ocean ecosystems if the benefits from these industries, and the growth of these benefits, are to be sustained over long periods.

In 2017, the ocean and climate community sought to define Blue Economy as a low-carbon economy concept distinct from ocean economy.

The Blue Economy concept is being pioneered at the national level, particularly by SIDS. In 2015, the Government of Seychelles began to implement its *Blue Economy Strategic Roadmap* as a pathway to realize sustainable ocean-based economic development. Seychelles has a dedicated agency to oversee the Roadmap, which is intended to support economic diversification, food security, sustainable management of ocean and coastal ecosystems, and job growth. Consideration of sustainable ocean management in national economic planning is a critical step in building resilience to climate change impacts. Blue Economy is also being pioneered by the Government of Grenada. A 2016 World Bank report, *Toward a Blue Economy: A Promise for Sustainable Growth in the Caribbean*, highlighted Grenada's Blue Growth initiative.[71] The plan expands marine monitoring and management while growing fishery and tourism industries in a sustainable, low-carbon manner.

The development of a Blue Economy is described by the Economist Intelligence Unit in a 2015 report: "A sustainable (blue) ocean economy emerges when economic activity is in balance with the long-term capacity of ocean ecosystems to support this activity and remain resilient and healthy."

Blue Economy is a term that is not seen in the UNFCCC process at this stage, but it had a high profile at the June 2017 UN Oceans Conference on SDG 14. Some side events at the conference wrestled with the creation of a universal definition of "blue economy" that includes a low-carbon criteria; 10 side events across the 5 days of the conference explicitly mentioned blue economy in their titles. 47 voluntary commitments to the Oceans Conference mention development of a blue economy, while the term "blue growth" was used in 22 commitments.[72] Some side events and voluntary commitments defined Blue Economy as explicitly sustainable and low-carbon, and others did not. For example, the SIDS-SIDS Partnership on Sustainable Energy for Blue Island Economies is dedicated to building marine energy sectors in SIDS that are renewable.[73] Other initiatives focused solely on development of economic sectors, including offshore oil and gas development. The ROCA side event at the conference, titled *Addressing Oceans and Climate and Building the Blue Economy: Essential to SDG 14 Implementation*, focused on the opportunities offered by Blue Economy strategies that are low-carbon, and the importance of addressing the full range of climate change impacts particularly affecting the 183 coastal and island nations around the world.

Three side events on the Blue Economy were co-organized by the Governments of Grenada, Cape Verde, and Iceland at the Ocean Conference. These side events highlighted the challenges faced by SIDS in accessing their ocean resources for blue growth, framed in the context of maintaining sustainability (including

68 World Bank and United Nations Department of Economic and Social Affairs. 2017. The Potential of the Blue Economy: Increasing Long-term Benefits of the Sustainable Use of Marine Resources for Small Island Developing States and Coastal Least Developed Countries. World Bank, Washington DC. https://openknowledge.worldbank.org/bitstream/handle/10986/26843/115545.pdf?sequence=1&isAllowed=y

69 Patil, P.G., Virdin, J., Michele Diez, S., Roberts, J., and Singh, A. Toward a Blue Economy: A Promise for Sustainable Growth in the Caribbean. World Bank Group: 2016. https://openknowledge.worldbank.org/bitstream/handle/10986/25061/Demystifying0t0the0Caribbean-0Region.pdf?sequence=4

70 OECD (Organization for Economic Cooperation and Development). 2016. The Ocean Economy in 2030. Paris: OECD

71 Patil, P.G., Virdin, J., Michele Diez, S., Roberts, J., and Singh, A. Toward a Blue Economy: A Promise for Sustainable Growth in the Caribbean. World Bank Group: 2016. https://openknowledge.worldbank.org/bitstream/handle/10986/25061/Demystifying0t0the0Caribbean-0Region.pdf?sequence=4

72 Vierros, Marjo. 2017. "Preliminary analysis of voluntary commitments." https://sustainabledevelopment.un.org/content/documents/16542Short_Analysis_of_Voluntary_Commitments.pdf

73 https://oceanconference.un.org/commitments/?id=20608

low-carbon) while improving their ability to utilize growing ocean-based industries such as offshore wind and seabed mining.[74] One side event introduced a cooperative platform on Blue Bioeconomy in Small Islands, hosted by the Nordic Council of Ministers, FAO, and other partners. The platform would provide a venue to share lessons learned and experiences related to building a sustainable blue economy in SIDS.

At the 2017 Our Ocean Conference in Malta, 78 concrete commitments under the theme of Blue Economy have been announced worth almost EUR 1.6 billion. For example, the United Kingdom announced EUR 9.1 million between 2017 and 2018 to support SIDS to preserve their marine environments and tap into maritime resources to catalyse economic development in a sustainable way across Commonwealth countries. In addition, the European Union announced that it will launch a EUR 14.5 million investment initiative in 2017 to promote a sustainable Blue Economy in the European Union. Around EUR 8 million of the fund is to provide start-up grants for high-potential projects in emerging Blue Economy sectors across the EU. In order to better monitor and combat marine litter, a further EUR 2 million will go towards providing support for innovative technologies to monitor and/or combat marine litter in waters around the European Union. Furthermore, EUR 3 million will go towards facilitating twinning projects in the Mediterranean Sea Basin, such as between maritime training and education institutes, businesses operating in the Blue Economy and local fishing communities.

74 Adopting the Blue Economy: A viable path to Sustainable Development in Small Island Developing States. https://nicholasinstitute.duke.edu/sites/default/files/FinalConcept_SideEventSeries_BlueEconomy_Jun4.pdf

7. 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.

Estimates from various organizations of the number of refugees that could be displaced within the century range from 50 million to 1 billion (see discussion in Roadmap report). International Organization for Migration projections from 2009 estimate that 200 million people will be displaced by 2050 due to overall changes in the environment.[75] Some countries face more vulnerability than others; for example, in Vietnam, 1 million people could be displaced from the Mekong delta and the surrounding area by 2050 due to sea level rise and saltwater intrusion.[76] Researchers at Cornell grappled with the question in 2017, publishing research focusing solely on displacement due to sea level rise that estimated 2 billion people could by displaced by this phenomenon by 2100.[77] The authors used popula-

75 International Organization for Migration (IOM). (2009). Migration, Environment, and Climate Change: Assessing the Evidence. Available at: http://publications.iom.int/system/files/pdf/migration_and_environment.pdf

76 Vafeidis, A., Neumann, B., Zimmermann, J. and Nicholls, R.J. (2011) Analysis of land area and population in the low-elevation coastal zone. Commissioned by UK Government Foresight Project, Migration and Global Environmental Change. Available online: http://www.bis.gov.uk/assets/bispartners/foresight/docs/migration/modelling/11-1169-mr9-land-and-population-in-the-low-elevation-coastal-zone.pdf

77 Geisler, C. and Currens, B. Impediments to inland resettlement under conditions of accelerated sea level rise. Land Use Policy 66:322.

tion growth data, sea level rise projections, and current patterns of movement to make this estimate. They highlighted the need to proactively prepare for residential retreat and "make room" inland, in addition to armoring and preparing major coastal cities.

Progress and Ways Forward Within the UN Process

Several UN agencies have devoted attention to migration and displacement. Thus far, the UNFCCC has discussed displacement mostly in the context of the Warsaw Mechanism for Loss and Damage. The COP reviewed the Mechanism at COP 22 in November 2016 and recommended expansion of the program through creation of additional expert groups and working groups, requesting additional collaboration with scientists, and inviting the appointment of a loss and damage contact point through national UNFCCC focal points.[78] The Loss and Damage Mechanism could become an important resource for nations experiencing irreparable damages due to climate change, such as loss of habitable coastal areas and subsequent human displacement.

Researchers at Cornell estimated in 2017 that 2 billion people could be displaced by sea level rise in 2100.

The International Organization for Migration (IOM), the UN Migration Agency, released the *IOM Pacific Strategy: 2017-2020*.[79] The report is intended to give guidance to Pacific national and regional leaders as they strengthen their migration programming and structures. The IOM outlined three overarching priorities for their strategy in the Pacific region: "1) migrants and communities in the Pacific benefit from migration as a sustainable development and climate change adaptation strategy; 2) displaced persons and affected communities in the Pacific are protected from and resilient to the impact of natural disasters and climate change; 3) migrants in the Pacific enjoy protection from human rights abuses and are able to migrate in a safe, orderly and dignified manner." These three principles are applicable to all communities affected by climate-induced displacement, and the IOM's emphasis on supporting their implementation in the near future is a strong step toward managing the risks associated with climate-induced displacement.

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. The UNISDR summit on the 2017 Global Platform for Disaster Risk Reduction, held in May 2017 in Cancun, expanded discussions on the implementation of the Sendai Framework for Disaster Risk Reduction 2015-2030. The Sendai Framework has a great deal of applicability to climate migration preparedness, especially with respect to migration that occurs as a result of sudden disasters that are becoming more frequent or damaging due to climate change. The Sendai Framework places the focus on risk reduction, rather than after-the-fact disaster management, and emphasizes risk reduction across all sectors. It provides clear structure on how to assess successful risk reduction policies, and clear pathways toward avoiding the creation of new risk (ex. building new infrastructure in risky flood plain areas) and reducing existing risk (ex. adapting existing infrastructure in flood plains to be more resilient).

UNISDR's handbook on city resilience contains guidelines on dealing with temporary or long-term displacement in a manner which is accessible and practical for local leaders. It also highlights the Sendai Framework for Disaster Risk Reduction, which has a good deal of applicability to preparedness measures for displacement.[80]

Pacific SIDS have been proactive leaders in the area of climate-induced displacement preparedness. Tuvalu has worked to bring the issue of climate-induced displacement to the attention of the UN General Assembly in 2016 and 2017. Tuvalu is only 15 ft above sea level at the highest point, and failure to meet a 1.5°C warming limit would likely make the entire country unlivable by the end of the century. The nation's Prime Minister, along with some other Pacific SIDS, has been pushing for the appointment of a UN Special Representative to the Secretary-General on Climate and Security and for a new UNGA resolution to create possible legal frameworks for managing climate-induced displacement.[81]

In September 2016, just before COP 22, the UNGA adopted the New York Declaration for Refugees and Migrants. The Declaration contains strong commitments to proactive global governance of migration that strengthens capacities to host, educate, protect, and employ refugees and migrants.[82] It also details concrete actions to support these commitments, including an agreement to hold negotiations at an international intergovernmental conference to adopt a global compact for safe and orderly migration in 2018. The goal is to develop

78 FCCC/CP/2016/10/Add.1 . http://unfccc.int/resource/docs/2016/cop22/eng/10a01.pdf

79 International Organization for Migration. "IOM Pacific Strategy: 2017-2020." Canberra: IOM 2017. https://publications.iom.int/system/files/pdf/iom_pacific_strategy.pdf

80 UNISDR. How to Make Cities More Resilient: A Handbook for Local Government Leaders. http://www.unisdr.org/campaign/resilientcities/assets/documents/guidelines/Handbook%20for%20local%20government%20leaders%20[2017%20Edition].pdf

81 Hon. Enele Sopoega. Statement by the Hon. Enele Sopoega, Prime Minister of Tuvalu, at the High Level Roundtable on Disasters and Climate Change and the World Humanitarian Summit. 24 May 2016. http://www.agendaforhumanity.org/sites/default/files/resources/2017/Jul/Statement_by_the_Hon_Enele_Sopoaga_Prime_Minister_of_Tuvalu_RT6.pdf

82 A/RES/71/1. New York Declaration for Refugees and Migrants. http://www.un.org/en/ga/search/view_doc.asp?symbol=A/RES/71/1

a set of common international norms and principles for migration, as well as guidelines on the treatment of migrants and refugees. It will be important to ensure representation of climate-induced migration and displacement at the 2018 UNGA conference.

National, Regional, and Civil Society Initiatives

Continuing the trend of SIDS leadership in this area, the Pacific Climate Change and Migration (PCCM) Project, funded by the EU and implemented by the UN Economic and Social Commission for Asia and the Pacific (UN ESCAP) and UNDP, completed its work period in December 2016. It produced a series of reports supporting labor migration schemes for Pacific island states (such as Kiribati, Tuvalu, Nauru, and a few others), as well as a guide geared toward displaced persons from these countries on finding employment overseas.[83]

In September 2016 the UNGA adopted the New York Declaration for Refugees and Migrants. The Declaration contains strong commitments to proactive global governance of migration that strengthens capacities to host, educate, protect, and employ refugees and migrants.

In September 2016, Pacific Leaders endorsed the Framework for Resilient Development in the Pacific (FRDP) as an integrated approach to minimizing climate disaster risks.[84] The FRDP is intended to coordinate with and draw from related global agreements, such as the Sendai Framework for Disaster Risk Reduction and the SDGs, to apply a region-specific low-carbon sustainable development plan that increases resilience to impacts. The FRDP could be an important set of guidelines to use as a model for integrating disaster risk reduction, climate preparedness, and sustainable development in a regionally specific, cross-sectoral approach.

In 2015, a global consultation of 109 national delegations approved the Nansen Initiative: An Agenda for the Protection of Cross-Border Displaced Persons in the Context of Disasters and Climate Change.[85] The Nansen Initiative Protection Agenda sets forth a comprehensive approach to disaster-related displacement within and across borders by presenting best practices, identifying needs and action areas, and proposing multiple policies. It details three priority areas of action: "collecting data and enhancing knowledge, enhancing the use of humanitarian protection measures, and strengthening the management of disaster displacement risk in the country of origin." The Protection Agenda places an emphasis on the concept of "migration with dignity," which is migration that is facilitated by preparedness and minimizing of health and economic risks.

In May 2016, the Platform on Disaster Displacement (PDD) was created at the World Humanitarian Summit to carry out the mission of 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. This comprehensive workplan contains invaluable guidance for decision-makers at the national, regional, and global levels. One highlight of the PDD's actions in 2017 was the roll-out of a comprehensive plan for managing displacement across borders in Central America, complete with a workshop and simulation exercise by the governments of Costa Rica and Panama.

Displacement Solutions, a nonprofit working closely with UN humanitarian efforts, has ramped up its actions in the last few years. It established the Myanmar National Climate Land Bank (MNCLB) in May 2017 to test the concept of land banks, which are institutional tools to set aside parts of State lands to prevent land conflict associated with climate displacement.[86] The project, along with other Displacement Solutions efforts, aims to address climate displacement by heading off potential conflicts and issues of access to land for displaced persons.

Increased collaboration among relevant UN agencies, such as the UNFCCC, UNISDR, and the IOM, will be vital in providing the international and regional support systems needed to reduce human and economic losses.

Going forward, climate-induced migration and displacement will likely become a lightning rod issue in the ocean and climate policy sphere. The work of various UN agencies, national governments, and civil society detailed above indicates that there is growing recognition of the issue, and some proactive policies are being considered. Increased collaboration among relevant UN agencies, such as the UNFCCC, UNISDR, and the IOM, will be vital in providing the international and regional

83 http://www.unescap.org/subregional-office/pacific/pacific-climate-change-and-migration-project

84 Framework for Resilient Development in the Pacific: An Integrated Approach to Address Climate Change and Disaster Risk Management 2017-2030. http://www.forumsec.org/resources/uploads/embeds/file/Annex%201%20-%20Framework%20for%20Resilient%20Development%20in%20the%20Pacific.pdf

85 http://disasterdisplacement.org/wp-content/uploads/2014/08/EN_Protection_Agenda_Volume_I_-low_res.pdf

86 Displacement Solutions. 25 May 2016. New DS Project to Prevent Climate Displacement Commences in Myanmar: Establishing the Myanmar National Climate Land Bank. Accessed 9 August 2017. http://displacementsolutions.org/new-ds-project-to-prevent-climate-displacement-commences-in-myanmar-establishing-the-myanmar-national-climate-land-bank/

support systems needed to reduce human and economic losses. Spreading the use of the Sendai Framework as a method of disaster preparedness and risk management will also be an important step as well. A key event to watch in 2018 will be the General Assembly's intergovernmental conference on international migration.

8. Financing

Roadmap Recommendation: Adaptation and mitigation efforts in coastal and SIDS countries/communities should receive sufficient funding, through: 1) directing a significant portion of the current climate funds to coastal and SIDS issues, and 2) developing supplementary financing to support adaptation and mitigation methods through innovative approaches and partnerships.

Discussions on long-term climate funding at COP 22 in Marrakech commended Parties' contributions thus far, but urged increased funding particularly in the area of adaptation. Annex I to the Report of the COP on its 22nd Session urged ramped up private sector adaptation finance, increased accessibility of funds for SIDS, and strengthening of national financing management in communication with international or regional financial resources. [87]

The Green Climate Fund reported on their activities for 2016 to Parties at COP 22, presenting its strategic vision "promoting the paradigm shift toward low-emission and climate-resilient development pathways" and "supporting the implementation of the Paris Agreement within the evolving climate finance landscape."[88] The GCF outlined a few priorities for 2017. These include the creation of national communication points particularly in the Asia-Pacific region, engagement of private sector entities, and the approval of up to $3 million per country to fund their National Adaptation Plans (NAPs).[89] The GCF was identified as the primary funding entity for nations needing assistance to meeting their Paris Agreement NDCs and National Adaptation Plans (NAPs). One action that the GCF is taking to streamline financing resources is the simplification of its application processes and templates for microscale activities in LDCs and SIDS.

The Global Environment Facility also reported to COP 22. The GEF is going into its seventh replenishment period, with the new mandate to support the Paris Agreement now in force. A major development discussed at COP 22 was the approval of the Trust Fund for the Capacity Building Initiative for Transparency.[90] The GEF is considering how to support NDCs and is encouraging governments to align GEF programming with NDC goals. The GEF contributes to numerous renewable energy projects in island and coastal nations, although the only GEF project operating in the 2016 fiscal year that explicitly deals with oceans and coasts is an ecosystem-based management strategy in St. Lucia involving $5 million from GEF and $25.8 million in co-funding.[91]

Thorough examination of assessments of costs of adaptation, mitigation, and displacement

A useful 2016 study on the costs of coastal habitat restoration found that median and average costs for restoring one hectare of coastal habitat are $80,000 and $1,600,000 respectively, and cautions that only about 40-60% of restored coastal vegetation survives these projects in the subsequent 1-2 years.[92] Mangroves and coral reefs were significantly less expensive to restore than seagrasses, salt marshes, and oyster reefs. Restoration costs were significantly lower in projects in developing countries, as compared to developed countries. Seagrass restoration was determined to be the least feasible project type, with relatively high costs and low survival rates.

The Organization for Economic Cooperation and Development (OECD) released several reports and held

87 FCCC/CP/2016/10/Add.1 . http://unfccc.int/resource/docs/2016/cop22/eng/10a01.pdf

88 GCF/B.13/04. Fifth Report of the Green Climate Fund to the Conference of the Parties to the United Nations Framework Convention on Climate Change. http://www.greenclimate.fund/documents/20182/226888/GCF_B.13_04_-_Fifth_Report_of_the_Green_Climate_Fund_to_the_Conference_of_the_Parties_to_the_United_Nations_Framework_Convention_on_Climate_Change.pdf/5ca9f462-9a3b-41ab-a3c9-d66e78dcaaaf

89 FCCC/CP/2016/10/Add.1 . http://unfccc.int/resource/docs/2016/cop22/eng/10a01.pdf

90 FCCC/CP/2016/10/Add.1 . http://unfccc.int/resource/docs/2016/cop22/eng/10a01.pdf

91 FCCC/CP/2016/6. Report of the Global Environment Facility to the Conference of the Parties. https://www.thegef.org/sites/default/files/documents/UNFCCC_report.pdf

92 Bayraktarov, E., Saunders, M.I., Abdullah, S., Mills, M., Beher, J., Possingham, H.P., Mumby, P.J., and Lovelock, C.E. 2016. The cost and feasibility of marine coastal restorations. Ecological Applications 26(4): 1055-1074. DOI: 10.1890/15-1077

workshops on climate financing strategies in late 2016 to early 2017. One report, titled *Investing in Climate, Investing in Growth*, takes a slightly different look at measuring the costs associated with climate change mitigation and adaptation by modelling scenarios where investments in major industries related to climate (transport, energy, water, and agriculture/livestock) are consistently planned as long-term, low-emission, and climate resilient.[93] The long-run costs of maintaining those infrastructure investments are then compared with and without consideration of climate impacts and planning for climate adaptation. Overall, OECD concludes that the costs of mitigation and adaptation are minimized and economic growth can be maintained by coupling infrastructure growth in the four major sectors with low-carbon climate-resilient considerations, but only if this transition in planning occurs very soon and quickly. The report also grapples with the reality that there will be a trade-off between financing mitigation and adaptation measures; for example, pouring a larger percentage of funds into mitigation in the recent past may have helped reduce adaptation costs in the long run, but delaying the use of funds for adaptation measures may drive up adaptation costs.

Development of a financial tracking mechanism to report on financial flows to support climate change efforts related to oceans and coasts

Although many organizations have set up mechanisms to track climate finance in general, such trackers are usually not focused on financial flows related to the ocean, coasts, and SIDS. International funding mechanisms continue to give relatively little attention and funding to ocean and coastal climate issues, although this may slowly be changing. The World Bank Group reports its climate financing commitments by sector and groups investments such as coastal flood protection in with a broader environmental management "climate-smart land use" category. According to its Climate Action Plan for 2016-2020, the WBG has funded $1 billion worth of projects that have coastal resilience elements, compared to $15.6 billion in forestry-related climate projects and $8 billion in agriculture-related climate projects. However, the WBG also identified coastal and marine resilience as one of its key areas of action in supporting implementation of NDCs and plans to commit $3-5 billion in coastal management funds in Southeast Asia from 2016-2020. As mentioned earlier, the ROCA is developing a financial tracking mechanism for climate funds directed towards ocean and coasts in collaboration with Duke University.

The aim of this financial tracking mechanism is to build upon existing efforts, such as the work of the Foundation Center's www.fundingtheocean.org, to track public and eventually private financial flows to support adaptation of coastal and ocean communities and ecosystems. The mechanism would track multilateral public flows to coastal and small island developing states (SIDS), and allow for comparison against requests in the NDCs. As a starting point, since COP 22 with the support of the Oak Foundation, Duke University compiled a database of public flows from philanthropies, bi-lateral and multilateral agencies to support ocean fisheries, and within that category those funds explicitly targeted to small-scale fisheries (per SDG 14). This scan of 39 organizations suggested an active portfolio of funding to ocean fisheries and their supporting ecosystems of US$2.68 billion in 2015, of which almost three quarters was provided by the Global Environment Facility and the World Bank (Basurto et al. 2017).

In the coming months climate funds will be assessed in addition to multilateral agencies, and categories of support included beyond fisheries, in order to track flows that could support adaptation of coastal and ocean communities and ecosystems. This initial round of work on tracking public financing flows related to the oceans and coastal climate issues is being carried out via manual searches of agency databases, but will also generate recommendations for new codes that agencies could tag to investments, in order to allow for automated, real-time tracking.

Earmarked funds in global public finance mechanisms to support adaptation and mitigation in coastal areas and SIDS

$13.5 billion in funding for ocean projects in SIDS was included in the voluntary commitments registered for the UN Oceans Conference, although it is unknown at this time how much of this will be used in low-carbon or climate-adaptive ways.[94] The GCF's increase in funds for its Readiness Programme in the first half of 2017 included $130,000 for adaptation projects conducted by the Secretariat of the Pacific Community (SPC).[95]

The 2016 Report of the UNFCCC Standing Committee on Finance included a review on the topic of funding for loss and damage mechanisms, which is particularly important to SIDS and coastal communities facing sea level rise and storm risks. It also stated that the largest area of uncertainty in climate finance tracking is around private sector flows toward developing nations, which are not tracked as diligently as public developed-to-developing funds or multilateral development bank funds.[96]

93 OECD (2017), Investing in Climate, Investing in Growth, OECD Publishing, Paris. DOI: http://dx.doi.org/10.1787/9789264273528-en

94 Vierros, Marjo. 2017. "Preliminary analysis of voluntary commitments." https://sustainabledevelopment.un.org/content/documents/16542Short_Analysis_of_Voluntary_Commitments.pdf

95 https://www.greenclimate.fund/-/gcf-lays-climate-finance-groundwork-in-africa-and-the-pacific

96 FCCC/CP/2016/10/Add.1 . http://unfccc.int/re source/docs/2016/cop22/eng/10a01.pdf

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.

The Paris Committee on Capacity Building (PCCB) was a major development of the Paris Agreement, as the first committee dedicated to capacity building under the UNFCCC. The PCCB held its first meeting in May 2017. The PCCB concluded that its first yearly theme for 2017 is capacity building as it relates to meeting the goals of NDCs. At the first meeting, the PCCB met with the operating entities of the UNFCCC Financial mechanism, as well as the Adaptation Committee, the LDC Expert Group, and the Technology Executive Committee.

At the 2017 Our Ocean Conference in Malta, 78 concrete commitments under the theme of Blue Economy have been announced worth almost EUR 1.6 billion. For example, the United Kingdom announced EUR 9.1 million between 2017 and 2018 to support SIDS to preserve their marine environments and tap into maritime resources to catalyse economic development in a sustainable way across Commonwealth countries. In addition, the European Union announced that it will launch a EUR 14.5 million investment initiative in 2017 to promote a sustainable Blue Economy in the European Union. Around EUR 8 million of the fund is to provide start-up grants for high-potential projects in emerging Blue Economy sectors across the EU. In order to better monitor and combat marine litter, a further EUR 2 million will go towards providing support for innovative technologies to monitor and/or combat marine litter in waters around the European Union. Furthermore, EUR 3 million will go towards facilitating twinning projects in the Mediterranean Sea Basin, such as between maritime training and education institutes, businesses operating in the Blue Economy and local fishing communities. 541 of the voluntary commitments to the Oceans Conference registered as relevant to SDG 14.a, *Increasing scientific knowledge, capacity, and technology transfer.*[97] Not all of them are directly related to climate, but can support a wide range of sustainable ocean management initiatives. The largest financial commitment registered with the Oceans Conference was an $8 billion loan from the European Investment Bank to support SIDS' resilience to climate change, geared toward a combination of capacity development and adaptation support.[98]

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

The "Call for action" that was released as an outcome document to the UN Oceans Conference called for increased support of marine research, particularly in developing nations.[99] The need for ramped-up marine research was one of the central recommendations emanating from the conference, with delegates and civil society both noting the need to increase the ability of developing nations, particularly SIDS and coastal nations, to monitor the ocean environment. The document's paragraph on marine research calls upon stakeholders to:

Dedicate greater resources to marine scientific research, such as interdisciplinary research and sustained ocean and coastal observation, as well as the collection and sharing of data and knowledge, including traditional knowledge, in order to increase our knowledge of the ocean, to better understand the relationship between climate and the health and productivity of the ocean, to strengthen the development of coordinated early warning systems on extreme weather events and phenomena, and to promote decision-making based on the best available science, to encourage scientific and technological innovation, as well as to enhance the contribution of marine biodiversity to the development of

97 Vierros, Marjo. 2017. "Preliminary analysis of voluntary commitments." https://sustainabledevelopment.un.org/content/documents/16542Short_Analysis_of_Voluntary_Commitments.pdf

98 EIB confirms commitment to support small island states and blue economy. 7 June 2017. http://www.eib.org/infocentre/press/releases/all/2017/2017-143-eib-confirms-commitment-to-support-small-island-states-and-blue-economy.htm

99 A/CONF.230/11 https://undocs.org/A/CONF.230/11

developing countries, in particular small island developing States and least developed countries.[100]

Strengthen the advancement of global marine observations, research, and related capacity development within the UNFCCC processes and beyond.

The Preparatory Committee established by resolution 69/292 (Development of a legally binding instrument under the UN Convention on the Law of the Sea on the conservation and sustainable use of marine biological diversity of areas beyond national jurisdiction) continued its work with a fourth session in July 2017. These negotiations to create a BBNJ ILBI are discussed earlier in this report. The oceans and climate community has monitored the efforts made in the this to establish legally binding management guidelines for ABNJ since the degradation of BBNJ, among other human impacts in the ABNJ, can interact with and exacerbate the effects of climate change on ocean health. If the new instrument effectively supports increased capacity for marine research and management in developing nations, particularly SIDS, these increased capabilities will also help these nations manage their ocean resources while accounting for climate impacts.

Ahead of the 4th BBNJ PrepCom, the Chair provided a non-paper to summarize the proposals and ideas of the delegates. The new international legally binding instrument on biodiversity beyond national jurisdiction is expected to include aspects which, inter alia, support the increased coverage and cohesive management of MPAs, increased use of area-based management tools (ABMT), and an emphasis on capacity building and technology transfer.101 These elements would all be a step in the right direction for recommendation 6.2, as well as 3.3 (expansion of MPA coverage as an adaptation measure). As discussed elsewhere in this report, reducing the impacts of human activities through the creation of MPAs and use of ABMT and/or EbA approaches builds resilience of the ecosystems to the impacts of climate change.

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

Progress is being made on the IPCC Special Report on the Ocean and Cryosphere in a Changing Climate (SROCC). In March 2017, the IPCC Panel approved the outline for the SROCC, and the author nominations have been submitted but not released. The outline shows that the report will include a chapter on the implications of sea level rise for low-lying communities, as well as chapters that thoroughly examine the role of oceans in climate and the potential changes associated with climate change.[102] It will offer resilience and adaptation options, including a section on blue carbon and other services by coastal ecosystems. There will be one integrative cross-chapter box highlighting impacts and "cascading risks of climate driven changes, interacting with other drivers, on habitability, infrastructure, communities, livelihoods, loss of lives and assets and territories, ecosystems, coral reefs, access to resources, and on institutional, social, economic, and cultural aspects."[103] The report will be an important resource for raising awareness of the importance of oceans in climate and for disseminating accurate scientific information. The IPCC online hub indicates that the SROCC report is on track for completion and approval in 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

Some NDCs explicitly mentioned ramping up marine research and observations as part of their adaptation plans. Seychelles requested funding for a marine resource management institute, which is also relevant to recommendation 6.1. Other nations, including Eritrea, requested support for research activities and ocean observation as well. Going forward, the adequate support of these types of requests under NDCs will be an excellent avenue for making progress on capacity development, especially because these requests are based on the self-identified needs of countries.

The WMO released standards on National Climate Monitoring Products (NCMPs) to assist countries in producing globally consistent data monitoring climate markers such as rainfall variation and temperature anomalies as compared to standard long-term or preindustrial averages.[104] WMO is holding capacity development workshops to spread the use of standard measures and train national focal points who can produce and disseminate the NCMPs.

100 A/res/71/312. Resolution adopted by the General Assembly on 6 July 2017. Our ocean, our future: Call for action. http://www.un.org/ga/search/view_doc.asp?symbol=A/RES/71/312&Lang=E
101 http://www.un.org/depts/los/biodiversity/prepcom_files/Chairs_streamlined_non-paper_to_delegations.pdf
102 https://www.ipcc.ch/meetings/session45/Decision_Outline_SR_Oceans.pdf
103 https://www.ipcc.ch/meetings/session45/Decision_Outline_SR_Oceans.pdf
104 World Meteorological Organization. Statement on the State of the Global Climate in 2016. WMO: Geneva, 2017. https://library.wmo.int/opac/doc_num.php?explnum_id=3414

Enhance technical capacity development of vulnerable countries through the establishment of regional oceanographic centers to increase cooperation among States on ocean-climate research and multi-disciplinary observation (in accordance with SAMOA Pathway decision 58.f)

The Japan International Cooperation Agency (JICA) signed a grant agreement, up to US$8.5 million, with the Government of Samoa to build the Pacific Climate Change Center at the Secretariat of the Pacific Regional Environment Programme (SPREP) in Apia, Samoa, as a base for human resource training in the field of climate change in Oceania to improve the resiliency of the region to environmental and climate change.[105] The deal was agreed upon in 2015, and the designs for the building were approved in late 2017.

Minimize and address the impacts of ocean acidification, including through enhanced scientific cooperation at all levels and the continued development of the Global Ocean Acidification Observing Network (GOA-ON) (SDG 14.3)

14 countries mentioned ocean acidification research, mitigation, or adaptation in their NDCs.[106] Comparing this to 77 countries which mentioned similar concerns about ocean warming illustrates that acidification is not yet considered on the same level as warming, even though it is likely to be just as much of a stressor to ecosystems and human communities. Initiatives to study and address ocean acidification also maintained a strong presence at the June UN Oceans Conference. Some of these efforts are discussed elsewhere in this document.

At Our Ocean conference in Malta, the International Alliance to Combat Ocean Acidification announced that fifteen of its members will develop Ocean Acidification Action Plans by June 2019. The Alliance will also seek inclusion of ocean acidification and changing ocean conditions in members' NDCs developed pursuant to the Paris Agreement at COP 23 and 24. The Alliance also announced its commitment to grow from its present 47 members to over 60 members by June 2018.

The Global Ocean Acidification Observing Network (GOA-ON) has continued its efforts to monitor ocean acidification and raise awareness of this issue. They maintained a presence at the June Oceans Conference, and help their Executive Council meeting 25-27 April 2017. The council discussed a plan for developing a GOA-ON implementation strategy, particularly methods to integrate existing work happening in regional networks. The council expressed a need to increase collaboration between organizations collecting data and developing strategies on ocean acidification.[107]

Only one national NDC mentions ocean deoxygenation, yet this warming-linked problem is looming for many regions. The Global Ocean Oxygen Network (GO_2NE) IOC-UNESCO is tackling the problem of raising awareness globally and finding solutions.[108] This network brings together researchers from bays, estuaries and coastal systems with those studying deoxygenation in the open ocean to address data issues, capacity building, and the science underlying the causes and consequences ocean deoxygenation.

One example of regional efforts in filling the data and knowledge gap on ocean acidification is led by the Ocean Policy Research Institute of Sasakawa Peace Foundation in collaboration with Japan Agency for Marine-Earth Science and Technology (JAMSTEC), to develop "Marine Crisis Watch and Action" database and research platform for marine monitoring and prediction. The platform also aims to engage stakeholders in discussion of necessary adaptive and mitigating measures with a focus on the North Western Pacific region where the data gap is a serious constraint.

Expand public outreach and education efforts, following the Lima Declaration on Education and Awareness-raising (COP 20, 2014), to enhance individual capacity and public understanding of the ocean's role in planetary survival and in global and national well-being, of the risks posed to SIDS and coastal communities by climate change, and to catalyse public support for mitigation and adaptation responses

The June UN Ocean Conference received a good deal of press attention, and many of the discussions surrounding the Conference included addressing climate change as an important component of achieving SDG 14. 10 side events spread across the 5 days of the conference explicitly addressed climate and oceans. The outcome document of the conference and many of the press releases associated with the conference conveyed the nexus between ocean and climate to the public, and discussed the particular challenges faced by SIDS and coastal communities.

105 http://www.sprep.org/climate-change/new-pacific-climate-change-centre-to-be-hosted-at-sprep
106 Gallo, N.D., Victor, D.G., and Levin, L.A. 2017. Ocean commitments under the Paris Agreement. Nature Climate Change. DOI: 10.1038/NCLIMATE3422
107 http://www.goa-on.org/GOA-ON_Activities.php
108 IOC-UNESCO. 21 Sept 2017. "Global Ocean Oxygen Network: Scientists meet to discuss progress and future activities." http://www.unesco.org/new/en/media-services/single-view/news/global_ocean_oxygen_network_scientists_meet_to_discuss_prog/

The 2017 Our Ocean Conference was record-setting in terms of commitments announced and their total monetary value, compared to the previous Our Ocean conferences. The conference received a very positive global media and social media coverage (with nearly 16 million accounts reached; the main hashtag #OurOcean reached 107 million individuals). Beyond the media coverage, the Conference also managed to directly reach out to the wider public, with several public side events, including an international ocean youth summit at the University of Malta, 2 ocean film festivals (in Malta and Brussels) and a global campaign with more than 150 participating aquaria from all over the world. Such wide reach helped to communicate the challenges the oceans are facing, including those related to the climate change.

10. Conclusions: Looking Forward to 2020

The Paris Agreement marked a turning point for the international climate community in recognizing both the central role of the ocean in regulating climate and the dire consequences that ocean ecosystems and those who depend on them are facing. The authors of the Strategic Action Roadmap to Oceans and Climate Action: 2016-2020 and the partners of the ROCA initiative seek to drive forward this momentum and ensure the long-term success of both sustainable policies and ambitious, on-the-ground actions.

Continuing with previous Oceans Days at COP 21 Paris and COP 22 Marrakech, **the Oceans Action Day at COP 23 in Bonn will be held on 11 November as part of the Marrakech Partnership for Global Climate Action,** and is being organized by the Food and Agriculture Organization of the UN (FAO); the Global Ocean Forum (GOF); the Intergovernmental Oceanographic Commission of UNESCO (IOC-UNESCO); the International Union for the Conservation of Nature (IUCN); the Ocean and Climate Platform; the Ocean Policy Research Institute of the Sasakawa Peace Foundation, Japan; and the Oceano Azul Foundation, Portugal; and with additional co-organizing support from Conservation International; Future Ocean Alliance; the Government of Chile; the Government of Seychelles; Plymouth Marine Laboratory; the International Federation of Red Cross Red Crescent Societies; the ROCA; Scripps Institution of Oceanography; and the Nature Conservancy. The ROCA will present this report alongside the companion report to be presented by the OCIA, together providing a narrative of evolving policies and actions since the last COP. The Oceans Action Day will also host the signing of the *Because the Ocean* declaration by additional signatories to that pledge, organized by the Government of Chile.

A key opportunity for the oceans community to advance the oceans and climate agenda comes from the Fiji Presidency of UNFCCC COP 23, to be held in Bonn, Germany, 6-17 November 2017. The Presidency is developing an Oceans Pathway Partnership,

to include representatives of SIDS and coastal states; rotating co-chairs with SIDS and coastal state representatives; observer, civil society, private sector, and local governments; and key donors. The Oceans Pathway Partnership, led by the Presidency at COP 23, will prioritize recognition of the 2017 Call for Action from the UN Oceans Conference, call for a Programme of Work on Oceans and Climate Change by 2019, work towards the inclusion of oceans in the Facilitative Dialogue, and examine existing financial mechanisms of the UNFCCC for their effectiveness in supporting the adaptation work needed to maintain healthy oceans and the wellbeing of coastal and island populations.

The ocean and climate community should maintain its presence at numerous upcoming events to promote the ocean and climate agenda. These issues should be represented at the May 2018 meetings of the UNFCCC SBSTA, APA, and others. The 24th Conference of the Parties to the UNFCCC will occur in Katowice, Slaskie, Poland, from 3-14 December 2018. The United Nations General Assembly will schedule an intergovernmental conference to adopt a global compact on safe, orderly, and regular migration in 2018. The ocean and climate community can use that opportunity to emphasize the particular migration challenges being faced by island and coastal populations specifically due to climate change impacts. It is also expected that there will be an intergovernmental conference on an implementing agreement under UNCLOS on BBNJ in 2018, following the conclusion of the PrepCom. The relevance of this process to the ocean and climate community is discussed earlier in this report. Finally, the ocean and climate community should plan for the next. Our Ocean Conferences, to be held in Indonesia in 2018, in Norway in 2019, and in Palau in 2020. Previous Our Ocean Conferences have generated over $9.2 billion in commitments to ocean conservation.

The record sea surface temperatures, massive coral bleaching events, and stronger, wetter storms of 2016 and 2017 have added even more urgency to this mission. The 2017 Call for Action from the UN Oceans Conference and the increasing presence of oceans issues in the UNFCCC process are signals that the international community is becoming aware of this urgency and is acknowledging the linkages between sustainable ocean policies and climate change mitigation and adaptation. The appointment of a UN Special Envoy for Oceans represents a new pathway within the United Nations to seek effective representation of ocean and climate issues in the international policy sphere. Still, this trend must be pushed forward; every opportunity to enhance ocean-related mitigation and adaptation at each policy level must be seized, and new opportunities must be actively created and pursued.

A key opportunity to advance the oceans and climate agenda comes from the Fiji Presidency of UNFCCC COP 23 with its Ocean Partnership Initiative to specifically advance the oceans and climate issues within the UNFCCC process.

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