

Ocean Acidification: Falling Between the Legal Cracks of UNCLOS and the UNFCCC?

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Oceans have played a critical role in shielding Earth from some of the more serious impacts of climate change by absorbing approximately 30 percent of emitted anthropogenic carbon dioxide. However, this has resulted in an approximate 26 percent increase in acidity of oceans since the industrial period. This not only presents the scientific challenge of addressing the problem of ocean acidification and its impacts on ocean marine life, but also presents many legal challenges. This Article will assess if the existing international legal framework provides the necessary foundation to address these legal challenges. Specifically, this Article will analyze whether two key global regimes, the United Nations Framework Convention on Climate Change and United Nations Convention on the Law of the Sea, provide the necessary legal foundation to address ocean acidification. It concludes that while UNCLOS establishes the legal obligation of States to address ocean acidification, it does not by itself provide for the framework for taking the collective action needed for a significant reduction in carbon dioxide emissions. By contrast, the United Nations Framework Convention on Climate Change regime appears to provide a better vehicle for the collective action necessary to mitigate emissions of carbon dioxide causing ocean acidification.

Introduction.....	10
I. The International Climate Change Regime	12
A. UNFCCC	12
B. Oceans Under the UNFCCC.....	17
C. The Kyoto Protocol and Doha Amendment	19

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D. The 2015 Paris Agreement	21
II. Law of the Sea.....	24
A. United Nations Convention on the Law of the Sea	24
B. The Internationally Legally Binding Instrument for the Conservation and Sustainable Use of Biological Diversity in Areas Beyond National Jurisdiction	27
Conclusion	28

INTRODUCTION

Oceans have played a critical role in regulating the impacts of climate change.¹ Without oceans absorbing excess heat and providing a sink for carbon emissions, the level of climate change would be much more than it is today.² As explained by the International Union for Conservation of Nature in its 2016 report on ocean warming,³ this critical role played by oceans has shielded the world from even greater impacts of climate change. It is unclear, however, how much longer the ocean can maintain this role.⁴

According to the Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report, oceans have absorbed more than 90 percent of the combined heat stored in the climate system between 1971 and 2010.⁵ As explained by the IPCC, the ocean's heat capacity is approximately one thousand times greater than that of the atmosphere.⁶ As a result, the Earth has been absorbing more heat than it has emitted back into the atmosphere, and most of this excess heat has been stored in the oceans.⁷ Oceans have also absorbed approximately 30 percent of emitted anthropogenic carbon dioxide, changing ocean chemistry and leading to ocean acidification.⁸ According to the IPCC Fourth Assessment Report, "[t]he uptake of anthropogenic carbon since 1750 has led to the ocean becoming more acidic, with an average decrease in surface pH of 0.1 units."⁹ Furthermore, the subsequent IPCC Fifth Assessment Report concluded with high confidence that oceanic uptake of carbon dioxide since the industrial era has corresponded with

1. Explaining Ocean Warming: Causes, Scale, Effects, and Consequences 18 (D. Laffoley & J. M. Baxter eds., 2016).

2. *Id.*

3. *Id.* at 40.

4. *Id.* at 47–48.

5. Intergovernmental Panel on Climate Change, Climate Change 2014: Synthesis Report 40 (2014) [hereinafter IPCC FIFTH REPORT].

6. INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, CLIMATE CHANGE 2007: THE PHYSICAL SCIENCE BASIS 389 (2007) [hereinafter IPCC FOURTH REPORT].

7. See INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, CLIMATE CHANGE 2013: THE PHYSICAL SCIENCE BASIS 266 (2013). See also Scott C. Doney et al., *Ocean Acidification: The Other CO₂ Problem*, 6 WASH. J. ENVTL. L. & POL'Y 213 (2016).

8. IPCC FIFTH REPORT, *supra* note 5, at 45.

9. IPCC FOURTH REPORT, *supra* note 6, at 48.

a 26 percent increase in acidity of the ocean.¹⁰ The pH balance of the oceans, which for millions of years remained stable, has entered a phase of decrease.¹¹

The impacts of this acidification of the oceans are far-reaching and complex.¹² According to the IPCC Fifth Assessment Report, marine organisms are at risk from progressively lower oxygen levels and higher rates of ocean acidification that are exacerbated by higher ocean temperatures. The Report underlines that coral reefs and polar ecosystems are highly vulnerable.¹³ Deep-sea coral reefs may be some of the most vulnerable ecosystems to ocean acidification.¹⁴ The increase in absorption of carbon dioxide by the oceans results in a reduction of aragonite saturation necessary for calcifying organisms—such as corals, certain plankton, and shellfish—to build calcium carbonate skeletons.¹⁵ Acidification will have direct impacts on a wide range of marine organisms that build shells from calcium carbonate.¹⁶ Key links in food webs are especially vulnerable in polar, sub-polar, deep sea, and upwelling regions.¹⁷

While the risks and consequences of ocean acidification continue to grow, it remains unclear if the existing international legal framework provides the necessary foundation to address this threat to the oceans, or whether the threat “exists in somewhat of an international legal twilight zone,” as described by Baird, Simons, and Stephens.¹⁸ As observed by Ellycia R. Harrould-Kolieb, “[d]espite their common driver, the processes and impacts of ocean acidification and climate change are distinct and it should not be assumed that policies intended to alleviate climate change will simultaneously benefit the oceans.”¹⁹ For example, the existing legal regime under the United Nations Framework Convention on Climate Change (UNFCCC)²⁰ is not limited to addressing carbon

10. IPCC FIFTH REPORT, *supra* note 5, at 41. Other changes in ocean chemistry attributed to climate change include deoxygenation, which is the depletion of oxygen. See MORITZ BOLLMANN ET AL., WORLD OCEAN REVIEW 44–47 (2010).

11. IPCC FOURTH REPORT, *supra* note 6, at 793 (“The main driver of these changes is the direct geochemical effect due to the addition of anthropogenic CO₂ to the surface ocean.”). See *id.* at 529.

12. See BOLLMAN ET AL., *supra* note 10, at 36–43.

13. IPCC FIFTH REPORT, *supra* note 5, at 13.

14. Carol Turley, *The Risk of Ocean Acidification to Ocean Ecosystems*, in THE OPEN OCEAN: STATUS AND TRENDS 207, 214 (2016).

15. Scott C. Doney et al., *Ocean Acidification: The Other CO₂ Problem*, 6 WASH. J. ENVTL. L. & POL’Y 213, 218–29 (2016).

16. *Id.*

17. Turley, *supra* note 14, at 207, 213.

18. Rachel Baird, Meredith Simons & Tim Stephens, *Ocean Acidification: A Litmus Test for International Law*, 4 CARBON & CLIMATE L. REV. 459, 460 (2009).

19. Ellycia R. Harrould-Kolieb, *Ocean Acidification and the UNFCCC: Finding Legal Clarity in the Twilight Zone*, 6 WASH. J. ENVTL. L. & POL’Y 613, 613 (2016); see generally Ellycia R. Harrould-Kolieb & Dorothée Herr, *Ocean Acidification and Climate Change: Synergies and Challenges of Addressing both under the UNFCCC*, 12 CLIMATE POL’Y 378, 378–90 (2012) (noting that although ocean acidification and climate change are linked by carbon dioxide, climate change mitigation policies will not necessarily reduce rising ocean acidity).

20. United Nations Framework Convention on Climate Change, May 9, 1992, S. TREATY DOC. No. 102–38, 1771 U.N.T.S. 107 [hereinafter UNFCCC].

dioxide emissions, and it does not directly address ocean acidification—which is exclusively a problem of increased concentrations of atmospheric carbon dioxide—specifically.²¹

This Article will critically examine the international legal framework in relation to human-induced ocean acidification and analyze whether two key global regimes, the UNFCCC and the United Nations Convention on the Law of the Sea (UNCLOS),²² provide the necessary legal foundation to address ocean acidification.

The Article will proceed in two parts. Part I will examine ocean acidification within the framework of the climate change regime under the UNFCCC, the Kyoto Protocol, and the Paris Agreement. Part II will examine ocean acidification within the framework of Part XII of the law of the sea regime under UNCLOS and also assess the possible role of a new internationally legally binding instrument for the conservation and sustainable use of biological diversity in areas beyond national jurisdiction under UNCLOS. The Article then concludes that the UNFCCC regime provides a better vehicle for collective action to mitigate emissions of carbon dioxide that are causing ocean acidification through a decision of the Conference or Meeting of the Parties, or a separate protocol. While UNCLOS does provide a legal foundation to address ocean acidification through individual State action, it does not provide for collective action without the adoption of a new instrument.

I. THE INTERNATIONAL CLIMATE CHANGE REGIME

A. UNFCCC

The UNFCCC is the principal global regime addressing climate change. Twenty years after Ambassador Arvid Pardo of Malta made his historic speech before the United Nations General Assembly on the common heritage of mankind in the minerals in the seabed, which laid the way for the eventual adoption of UNCLOS,²³ Malta once again spoke before the General Assembly in 1988. This time, it declared that climate change was a “common concern of mankind.”²⁴ This speech led the way to the eventual adoption of the UNFCCC at the historic United Nations Conference on the Environment and Development in 1992.²⁵ The UNFCCC is a framework instrument with universal

21. Harrould-Kolieb, *supra* note 19, at 613.

22. U.N. GAOR, 22nd Sess., 1515th mtg., U.N. Doc. A/C.1/PV.1515 (Nov. 1, 1967).

23. *Id.*

24. G.A. Res. 43/53, ¶ 1 (Dec. 6, 1988). Protection of global climate for present and future generations of mankind (1988).

25. UNFCCC, *supra* note 20.

membership²⁶ and it is the principal global agreement for climate change.²⁷ Its ultimate objective is stated in Article 2 as follows:

The ultimate objective of this Convention and any related legal instruments that the Conference of the Parties may adopt is to achieve, in accordance with the relevant provisions of the Convention, *stabilization of greenhouse gas concentrations in the atmosphere* at a level that would prevent dangerous anthropogenic interference with the climate system. Such a level should be achieved within a time-frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner. (emphasis added)²⁸

Article 2 of the UNFCCC provides a three-prong indicator for assessing successful achievement of the ultimate goal. The first indicator is the stabilization of greenhouse gas concentrations in the atmosphere, the second is that such stabilization is to be at a level that prevents dangerous anthropogenic interference with the climate system, and the third looks to the temporal dimension that will allow for a natural period of adaptation.

It is unclear how ocean acidification fits into this framework. There is some debate among scholars about whether the UNFCCC reflects an atmospheric orientation approach or is instead a holistic approach that would include oceans as part of the climate system,²⁹ which is defined as “the totality of the atmosphere, hydrosphere, biosphere and geosphere and their interactions.”³⁰ Clearly the “hydrosphere” includes the ocean, but there is concern that the UNFCCC regime has a principally atmospheric orientation that does not necessarily correlate to ocean chemistry.³¹ This atmospheric orientation is reflected in different parts of the Convention. For example, the preamble states: “Concerned that human activities have been substantially increasing the atmospheric concentrations of greenhouse gases, that these increases enhance the natural greenhouse effect, and that this will result on average in an additional

26. There are 197 Parties to the UNFCCC. See *First Steps to a Safer Future: Introducing the United Nations Framework Convention on Climate Change*, UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE, http://unfccc.int/essential_background/convention/items/6036.php (last visited Mar. 9, 2018).

27. See generally, DANIEL BODANSKY ET AL., INTERNATIONAL CLIMATE CHANGE LAW (2017).

28. UNFCCC, *supra* note 20, at art. 2.

29. Baird, Simons, and Stephens refer to Article 2 of the UNFCCC as having an “atmospheric focus.” Baird et al., *supra* note 18, at 464. However, Harrould-Kolieb is of the view that the UNFCCC is focused on the climate system rather than the atmosphere. Harrould-Kolieb, *supra* note 19, at 626. See also Yangmay Downing, *Ocean Acidification and Protection under International Law from Negative Effects: A Burning Issue Amongst a Sea of Regimes*, 2 CAMBRIDGE J. INT’L & COMP. L. 242, 250 (2013) (contending that the UNFCCC is part of a “climate regime” that appears to be “the most appropriate mechanism to mitigate ocean acidification”).

30. UNFCCC, *supra* note 20, at art. 1(3).

31. Baird et al., *supra* note 18, at 463–64.

warming of the Earth's surface and atmosphere and may adversely affect natural ecosystems and humankind"³²

The first indicator under Article 2 evinces a strong atmospheric orientation by linking the successful achievement of the UNFCCC to the stabilization of atmospheric greenhouse gas concentrations at a level that will prevent dangerous anthropogenic interference with the climate system.³³ This climate change regime measures the impact of the different greenhouse gases on the climate by their global warming potential in relation to carbon dioxide based on a calculation of the amount of carbon dioxide needed to produce the same amount of warming by the greenhouse gas in question.³⁴

While mitigation of carbon dioxide emissions is critical to reducing anthropogenic climate change as well as ocean acidification, nonetheless, under this current climate change regime, reduction of climate change could also be achieved by targeting greenhouse gases other than carbon dioxide.³⁵ Methane, for example, has a global warming potential over a period of twenty years that is seventy-two times that of the equivalent amount of carbon dioxide.³⁶ Reducing methane alone, however, would not reduce ocean acidification resulting from the absorption of carbon dioxide emissions. The UNFCCC does not account for this distinction.

Some therefore argue that the possible option to address climate change through the mitigation of other non-carbon-dioxide greenhouse gases poses a fundamental question as to the capacity of the UNFCCC as a framework to provide the necessary legal foundation to address ocean acidification.³⁷ However, others suggest that the overall stabilization of greenhouse gases under the UNFCCC is broad enough to include ocean acidification.³⁸ According to the Honolulu Declaration on Ocean Acidification and Reef Management, if carbon dioxide concentrations reach 560 parts per million, there will be a decrease by approximately 30 percent of coral skeletal growth of most corals; even before this happens, many reefs will shift from reef growth to reef erosion.³⁹

The second indicator under Article 2 assesses "dangerous" anthropogenic interference with the climate system.⁴⁰ As excessive emissions of anthropogenic

32. UNFCCC, *supra* note 20, at 166.

33. *Id.* at art. 2.

34. For example, this is expressly stated in Article 3 of the Kyoto Protocol. *See* Kyoto Protocol to the United Nations Framework Convention on Climate Change art. 3, Dec. 10, 1997, 37 I.L.M. 22, available at http://unfccc.int/kyoto_protocol/items/1678.php [hereinafter Kyoto Protocol].

35. Baird et al., *supra* note 18, at 464. *See also* Harrould-Kolieb & Herr, *supra* note 19, at 382.

36. IPCC FOURTH REPORT, *supra* note 6, at 212 tbl.2.14.

37. Baird et al., *supra* note 18, at 464.

38. *See* Harrould-Kolieb, *supra* note 19, at 625–26 (citing Heidi R. Lamirande, *From Sea to Carbon Cesspool: Preventing the World's Marine Ecosystems from Falling Victim to Ocean Acidification*, 34 SUFFOLK TRANSNAT'L L. REV. 183, 204 (2011)); Downing, *supra* note 29, at 251.

39. Ocean Acidification Workshop, *The Honolulu Declaration on Ocean Acidification and Reef Management*, 12 J. INT'L WILDLIFE L. & POL'Y 121, 122 (2009).

40. Baird, Simons, and Stephens pose the questions of "what is 'dangerous anthropogenic interference' with the climate system and is ocean acidification relevant for determining what is

induced carbon dioxide are the cause of ocean acidification, scholars question whether ocean acidification would fit into this assessment.⁴¹ While oceans may fall within the definition of the climate system,⁴² the key issue is whether ocean acidification would be included in the measurement of dangerous anthropogenic interference. As will be discussed further on, under the existing UNFCCC system, the principal role of oceans is as a pathway to mitigate against climate change. It is not evident that oceans are part of the climate system that is the object of dangerous anthropogenic interference under the UNFCCC's framework.

The third indicator for achieving the objective in Article 2 provides a complex set of sub-goals placed within temporal frameworks linked to both natural ecosystem adaptation and socio-economic adaptation that seeks to protect food security as well.⁴³ Article 2 appears to be based on the assumption that ecosystems will adapt more or less in tandem. However, this is not evident and requires solid scientific input. For example, with regard to acidification, what is the period needed for coral reefs to adapt naturally to ocean acidification? Likewise, the same question must be asked of the ability of shellfish to calcify and adapt to the other adverse impacts of ocean acidification. According to Baird, Simons, and Stephens, “[w]ith ocean acidification there is limited capacity for natural systems to adapt, although reducing other stressors on certain ecosystems may be of some assistance, at least temporarily.”⁴⁴ It may be that the objective of the UNFCCC regime as adopted under Article 2 of the UNFCCC will not be adequate to respond to ocean acidification. A separate objective, such as the development of a pH balance target specifically for ocean acidification, may be needed.

Article 3 of the UNFCCC lays out the priorities by which the Parties are to be guided in taking actions to achieve the objective of the Convention and to implement its provisions.⁴⁵ It provides, in part, that developed country Parties should take the lead in combating climate change and the *adverse effects* thereof.⁴⁶ The Convention defines the “[a]dverse effects of climate change” as “changes in the physical environment or biota resulting from climate change which have significant deleterious effects on the composition, resilience or productivity of natural and managed ecosystems or on the operation of socio-economic systems or on human health and welfare.”⁴⁷ While some scholars

dangerous?” Rachel Baird et al., *supra* note 18, at 463. While noting the atmospheric focus of Article 2 of the UNFCCC, they are doubtful whether determination of “dangerous anthropogenic interference” could be defined by reference to a dangerous ocean pH threshold. *Id.* at 464.

41. *Id.* at 463–64.

42. *Id.*; Downing, *supra* note 29, at 251.

43. UNFCCC, *supra* note 20, at art. 2.

44. Baird et al., *supra* note 18, at 462.

45. UNFCCC, *supra* note 20, at art. 3.

46. *Id.* at art. 3(1).

47. *Id.* at art. 1(1).

interpret adverse effects to exclude ocean acidification,⁴⁸ this definition does seem broad enough to encompass ocean acidification.⁴⁹ Changes in the physical environment resulting from climate change would include ocean acidification as it is directly caused by the absorption by the ocean of excessive concentrations of anthropogenic atmospheric carbon dioxide. Furthermore, there is scientific evidence showing the different deleterious impacts of ocean acidification on the productivity and resilience of natural and managed resources, such as coral reefs, fish stocks, and crustaceans.⁵⁰

In addition, assuming that ocean acidification does constitute an “adverse effect,” the UNFCCC includes several obligations that would require Parties to take action addressing the impacts of ocean acidification. It requires all Parties to take full account of the specific needs and special circumstances of developing country Parties, especially those that are *particularly vulnerable* to the adverse effects of climate change.⁵¹ There is also a financial corollary for this provision under Article 4(4), requiring Parties listed in Annex II to assist developing country Parties that are particularly vulnerable to the adverse effects of climate change in meeting costs of adaptation to those adverse effects.⁵² There is evidence that developing countries in specific regions of the world, such as the South Pacific, will be particularly vulnerable to ocean acidification.⁵³ Lastly, under the Convention, all Parties “should take precautionary measures to anticipate, prevent or minimize the causes of climate change and mitigate its adverse effects.”⁵⁴ This would apply to ocean acidification under the definition of adverse effects.

If ocean acidification is an adverse effect of climate change, which it clearly seems to be, how will these provisions be applied? Would ocean acidification come within the loss and damage mechanism adopted by the Parties in Warsaw in 2013⁵⁵ and included in the 2015 Paris Agreement?

48. See Rakhyun E. Kim, *Is a New Multilateral Environmental Agreement on Ocean Acidification Necessary?*, 21 REV. EUR. COMMUNITY & INT’L ENVTL. L. 243, 245–46 (2012).

49. UNFCCC, *supra* note 20, at art. 1(1).

50. SECRETARIAT OF THE CONVENTION ON BIOLOGICAL DIVERSITY, AN UPDATED SYNTHESIS OF THE IMPACTS OF OCEAN ACIDIFICATION ON MARINE BIODIVERSITY 7–9 (Sebastian Hennige et al. eds., 2014), available at <https://www.cbd.int/doc/publications/cbd-ts-75-en.pdf>.

51. See UNFCCC, *supra* note 20, at art. 4(8).

52. *Id.* at art. 4(4).

53. Contribution of the Pacific Community (SPC) to Part I to the report of the Secretary-General on oceans and the law of the sea, pursuant to General Assembly draft resolution A/71/L.26, entitled “Oceans and Law of the Sea”, focusing on “The effects of climate change on oceans”, U.N. Doc. LOS/SGR/2017 (Jan. 13, 2017), available at http://www.un.org/depts/los/general_assembly/contributions_2017/SPC.pdf (“The combined effects of increased coral bleaching and ocean acidification are expected to reduce live coral cover (estimated at 20–40% for the Pacific in 2010) by 50% by 2050 under good management, and by 75% under poor management . . .”).

54. UNFCCC, *supra* note 20, at art. 3(3).

55. See U.N. Framework Convention on Climate Change, *Report of the Conference of the Parties on its Nineteenth Session*, U.N. Doc. FCCC/CP/2013/10/Add.1, Decision 2/CP.19 (Jan. 31, 2014), available at <http://unfccc.int/resource/docs/2013/cop19/eng/10a01.pdf>.

B. Oceans Under the UNFCCC

While questions remain about the UNFCCC's objective indicators and the action plan's ability to adequately address ocean acidification, the climate change mitigation role of the marine environment and oceans is expressly recognized under the UNFCCC.⁵⁶ The preamble calls for the Parties to be "[a]ware of the role and importance in terrestrial and marine ecosystems of sinks and reservoirs of greenhouse gases."⁵⁷ The Convention also mentions oceans and the marine environment in Article 4(1)(d), which requires Parties to "[p]romote sustainable management, and promote and cooperate in the conservation and enhancement, as appropriate, of sinks and reservoirs of all greenhouse gases not controlled by the Montreal Protocol, including biomass, forests and oceans as well as other terrestrial, coastal and marine ecosystems."⁵⁸ In this provision the Convention cast the oceans in a role for mitigation of greenhouse gases, which is limited to carbon dioxide emissions as oceans do not absorb other greenhouse gas emissions.

While this provision can be read as requiring States to adopt conservation measures to protect the oceans against acidification as an adverse impact of climate change, there are, however, different views on this. Baird, Simons, and Stephens take the view that the focus of Article 4(1)(d) is on mitigation through the enhancement of passive absorption of anthropogenic carbon dioxide and even argue that Article 4(1)(d) can be interpreted as encouraging active ocean sequestration of carbon dioxide.⁵⁹ On the other hand, Harrould-Kolieb sees the possibility for article 4(1)(d) to create an obligation to protect marine and coastal ecosystems and the ocean from acidification.⁶⁰

If oceans have reached their maximum level of saturation in the absorption of atmospheric carbon dioxide, a logical reading of Article 4(1)(d) in light of the object and purpose of the UNFCCC, would imply that there is an obligation for Parties to take measures to mitigate ocean acidification, even if the objective were only to restore their carbon dioxide absorption capacity as a sink or reservoir. However, the UNFCCC is principally a framework convention oriented towards providing a legal foundation for the mitigation of greenhouse gases in those countries listed in its Annex I.⁶¹ On the other hand, it could be

56. UNFCCC, *supra* note 20.

57. *Id.* at 166.

58. *Id.* at art. 4(1)(d).

59. Baird et al., *supra* note 18, at 464. *But see* Kim, *supra* note 48, at 245–46 (concluding that the UNFCCC regime that includes the Kyoto Protocol, does not impose an obligation on its Parties to prevent ocean acidification).

60. Harrould-Kolieb, *supra* note 19, at 630.

61. Baird et al., *supra* note 18, at 464. *See also* Downing, *supra* note 29, at 251–53. Countries listed in Annex I are: Australia, Austria, Belarus, Belgium, Bulgaria, Canada, Czechoslovakia, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, Latvia, Lithuania, Luxembourg, Netherlands, New Zealand, Norway, Poland, Portugal, Romania, Russian Federation, Spain, Sweden, Switzerland, Turkey, Ukraine, United Kingdom of Great Britain and Northern Ireland, United States of America.

interpreted to provide the foundation for all Parties to take measures individually or in cooperation to build ocean resilience against the adverse impacts of climate change, including ocean acidification. How to achieve this is an open question. Resilience building is already recognized under the climate change regime and should be applied as a measure to reduce the negative impacts of ocean acidification on marine life and ecosystems. For example, in relation to coral reefs, which are especially vulnerable to ocean acidification, scientists state that “[m]aintaining ecological resilience is the central plank of any strategy aiming to preserve coral reef ecosystems.”⁶²

To date, cooperative actions under the UNFCCC in relation to sinks and reservoirs have been taken in relation to the conservation and enhancement of forests under the United Nations Collaborative Programme on Reducing Emissions from Deforestation and Forest Degradation in Developing Countries, commonly referred to as the UN-REDD⁶³ and REDD+ programs.⁶⁴ Similar actions have not yet been taken for oceans. Initiatives such as the Blue Carbon Initiative, which is a global program working to mitigate climate change through the restoration and sustainable use of coastal and marine ecosystems, have developed extraneous to the UNFCCC regime.⁶⁵ However, the question remains whether measures geared only to enhance and conserve the mitigation role of the oceans would actually address the core problem of acidification caused by excess concentrations of carbon dioxide emissions.

To date, the impact of climate change on oceans has been an ancillary matter within the UNFCCC regime. As analyzed in detail by Harrould-Kolieb and Herr, ocean acidification was first introduced into the Subsidiary Body for Scientific and Technological Advice of the UNFCCC by the United Kingdom on behalf of the European Community in 2005.⁶⁶ The Subsidiary Body for Scientific and Technological Advice recognized ocean acidification as an emerging issue and highlighted the need for more research.⁶⁷ Still, mention of the impact of climate change on the ocean only appeared in a footnote in the 2010 Cancun

62. O. Hoegh-Guldberg et al., *Coral Reefs Under Rapid Climate Change and Ocean Acidification*, 318 SCIENCE 1737, 1738–39 (2007).

63. See *How We Work*, UN-REDD PROGRAMME, <http://www.un-redd.org/how-we-work> (last visited Mar. 9, 2018).

64. See *UN-REDD Programme Fact Sheet: About REDD+*, UN-REDD PROGRAMME, available at http://www.unredd.net/index.php?option=com_docman&view=document&alias=15279-fact-sheet-about-redd&category_slug=fact-sheets&Itemid=134 (last visited Mar. 9, 2018). See generally Christina Voigt, Introduction: The Kaleidoscopic World of REDD+, in RESEARCH HANDBOOK ON REDD+ AND INTERNATIONAL LAW (Christina Voigt ed., 2016).

65. The Blue Carbon Initiative is a joint undertaking coordinated by the Intergovernmental Oceanographic Commission of the United Nations Educational, Scientific and Cultural Organisation, the International Union for Conservation of Nature, and Conservation International. See *About the Blue Carbon Initiative*, THE BLUE CARBON INITIATIVE, <http://thebluecarboninitiative.org/about-the-blue-carbon-initiative/> (last visited Mar. 9, 2018).

66. Harrould-Kolieb, *supra* note 19, at 617.

67. See *id.* at 617–18. See also U.N. Framework Convention on Climate Change, *Report of the Subsidiary Body for Scientific and Technological Advice on its Forty-Second Session*, ¶ 6, U.N. Doc. FCCC/SBSTA/2015/2 (June 14, 2011).

Agreements.⁶⁸ This is shifting, however, and an increased attention to climate change and oceans is reflected in the decision by the IPCC to devote a separate assessment report to oceans and the cryosphere,⁶⁹ the prominent role displayed at the first United Nations Conference on the Oceans held in June 2017,⁷⁰ and the anticipated attention oceans will receive at the Conference of the Parties 23, of which Fiji will be the President.

C. The Kyoto Protocol and Doha Amendment

The UNFCCC does not provide for any detailed mitigation obligations other than a very general aim for developed country Parties and other developed country Parties listed in Annex I to reduce anthropogenic emissions by sources and to reduce emissions removals by sinks of greenhouse gases not controlled by the Montreal Protocol individually or jointly to their 1990 levels.⁷¹ The Kyoto Protocol was the key instrument adopted under the UNFCCC with specific targets for the mitigation of anthropogenic greenhouse gases for the period between 2008 to 2012.⁷² Article 3 of the Kyoto Protocol defines the overall objective of the Parties to reduce their overall emission of “aggregate anthropogenic carbon dioxide equivalent emissions of the greenhouse gases listed in Annex A by at least 5 percent below 1990 levels in the commitment period 2008 to 2012.”⁷³ Annex B of the Kyoto Protocol establishes the quantified emission limitation and reduction commitments individually for Annex I Parties to achieve by the end of 2012. Furthermore, in some cases Parties are allowed to increase their emissions.⁷⁴

In addition, complementing Article 4(1)(d) of the UNFCCC, as part of their commitment to achieve quantified emission limitation and reduction commitments, Article 2 requires each Party included in Annex I to implement policies and measures for the protection and enhancement of sinks and reservoirs of greenhouse gases not controlled by the Montreal Protocol. This includes an express call for the promotion of sustainable forest management practices, afforestation, and reforestation.⁷⁵ There is a notable focus on forests in the Kyoto Protocol, whereas, unlike under the UNFCCC, no express mention is made to

68. U.N. Framework Convention on Climate Change, *Report of the Conference of the Parties on its Sixteenth Session* n.3, U.N. Doc. FCCC/CP/2010/7/Add.1 (Mar. 15, 2011). See generally *Conference of the Parties*, UNITED NATIONS CLIMATE CHANGE, <http://unfccc.int/bodies/body/6383/php/view/reports.php>.

69. At its 43rd Session (Nairobi, Kenya, April 11–13, 2016), the IPCC Panel decided to prepare a special report on climate change and the oceans and the cryosphere. Decision IPCC/XLIII-7.

70. The first ever United Nations Oceans Conference was held at the United Nations Headquarters in New York from June 5th through 9th, 2017.

71. UNFCCC, *supra* note 20, at art. 4(2)(b).

72. Kyoto Protocol, *supra* note 34.

73. *Id.* at art. 3(1).

74. For example, Australia could increase its quantified emission limitation and reduction commitments by 108 percent; Iceland by 110 percent, and Norway by 101 percent.

75. See UNFCCC, *supra* note 20, at art. 4(1)(d); Kyoto Protocol, *supra* note 34, at art. 2(1)(a)(ii).

oceans or the marine environment.⁷⁶ Nevertheless, under the UNFCCC and Kyoto Protocol, Parties still have an obligation to implement policies and measures to conserve oceans in their capacity as sinks and reservoirs for carbon dioxide.⁷⁷

The Kyoto Protocol does not, however, provide a strong foundation to address ocean acidification. First, it includes only a modest target of achieving an aggregate reduction of a mere 5 percent of emissions of the greenhouse gases for only those Parties listed in Annex I of the UNFCCC and Annex B of the protocol. Second, the fact that this can be achieved through “carbon dioxide equivalent” emissions reductions, rather than carbon dioxide specifically, greatly diminishes the potential for the Kyoto Protocol to have any impact on addressing ocean acidification, which is exclusively a carbon dioxide problem.⁷⁸ Baird, Simons, and Stephens rightly note that the aggregate approach of Kyoto allows Parties to increase their emissions of carbon dioxide if they can counter this with a decrease in carbon equivalent greenhouse gas.⁷⁹ Consequently, addressing the carbon dioxide problem through the Kyoto Protocol would only bring incidental benefits to the extent that carbon dioxide is reduced.

The Kyoto Protocol had a limited life of four years, ending December 31, 2012.⁸⁰ It was amended and extended for a second term from 2013 to 2020 after prolonged negotiations in 2012 at the Meeting of the Parties held in Doha.⁸¹ However, no additional attention to oceans was given under the Doha Amendment. Further, the Doha Amendment also included an increase in the aggregate and individual quantified emission limitation and reduction commitments of Parties to Annex B, and added nitrogen trifluoride to the list of greenhouse gases covered.⁸² As of 2017, a gap remains to attain the 144 ratifications required for the Doha amendment to enter into effect.⁸³

76. Compare Kyoto Protocol, *supra* note 34, at art. 2(1)(a)(ii) (emphasizing “sustainable forest management practices”), with UNFCCC, *supra* note 20, at art. 4(1)(d) (noting “forests,” but also highlighting “ocean . . . , coastal and marine ecosystems”).

77. See UNFCCC, *supra* note 20, at art. 4(1)(d); Kyoto Protocol, *supra* note 34, at art. 2(1)(a)(ii).

78. See Kim, *supra* note 48, at 245–46.

79. Baird et al., *supra* note 18, at 464.

80. Kyoto Protocol, *supra* note 34, at art. 3(1).

81. U.N. Framework Convention on Climate Change, *Report of the Conference of the Parties to the Kyoto Protocol on its Eighth Session*, Dec. 1/CMP.8, U.N. Doc. FCCC/KP/CMP/2012/13/Add.1 (Feb. 28, 2013), available at https://treaties.un.org/doc/source/docs/Doha_Decision1_CMP.8-E.pdf.

82. *Id.* at 81.

83. In accordance with Article 20, Paragraph 4, the amendment will “enter into force for those Parties . . . on the ninetieth day after the date of receipt by the Depositary of an instrument of acceptance by at least” 144 Parties (three fourths of the Parties to the Kyoto Protocol). Kyoto Protocol, *supra* note 34, at art. 20(4). As of the writing of this paper only eighty-three Parties have ratified the amendment to the Kyoto Protocol. See *Status of Ratification of the Kyoto Protocol*, UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE, http://unfccc.int/kyoto_protocol/status_of_ratification/items/2613.php (last visited Mar. 9, 2018). As of March 9th, 2018, 110 States have ratified the Doha Amendment. *Doha Amendment to the Kyoto Protocol*, United Nations Treaty Collection, https://treaties.un.org/Pages/ViewDetails.aspx?src=TREATY&mtdsg_no=XXVII-7-c&chapter=27&clang=_en (last visited Mar. 9, 2018).

Furthermore, most of the ratifications to date are by developing country Parties without mitigation commitments under Annex B of the Kyoto Protocol.

D. The 2015 Paris Agreement

In 2015, twenty-three years following the adoption of the 1992 UNFCCC, States adopted the Paris Agreement on climate change.⁸⁴ The Paris Agreement seeks to strengthen the implementation of the UNFCCC and its objective as articulated in Article 2. Perhaps one of the most important aspects of the Paris Agreement was to quantify the otherwise ambiguous language of Article 2 of the UNFCCC by establishing a clear temperature range.⁸⁵ According to Article 2(1)(a), the Paris Agreement “aims to strengthen the global response to the threat of climate change,” including by “[h]olding the increase in the global average temperature to well below 2°C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5°C above pre-industrial levels.”⁸⁶ It remains unclear what impact this temperature objective will have on ocean acidification. The achievement of the temperature target(s) does not necessarily include taking into account ocean acidification or pH levels as part of the reduction of risks and impacts of climate change, a point raised by experts in the Report of the Structured Expert Dialogue prepared for the Conference of the Parties under the UNFCCC.⁸⁷ Although, the same report noted that with a temperature increase of 2°C the risks of ocean warming and acidification would become high.⁸⁸ Under the existing regime there is no direct system of linkage between temperature targets and reduction of carbon dioxide concentrations in the atmosphere with the pH level in the oceans.⁸⁹ This is a critical issue that requires additional scientific data and study, especially in light of data that

84. U.N. Framework Convention on Climate Change, *Report of the Conference of the Parties on its Twenty-first Session*, Dec. 1/CP.21, U.N. Doc. FCCC/CP/2015/10/Add.1 (Jan. 29, 2016), available at <https://unfccc.int/resource/docs/2015/cop21/eng/10a01.pdf> [hereinafter Paris Agreement]. The Paris Agreement was adopted on December 12, 2015 and entered into effect on November 4, 2016. There are currently 195 signatories and 175 Parties. *Paris Agreement – Status of Ratification*, UNITED NATIONS CLIMATE CHANGE, http://unfccc.int/paris_agreement/items/9444.php (last visited Mar. 9, 2018).

85. UNFCCC, *supra* note 20, at art. 2.

86. Paris Agreement, *supra* note 84, at art. 2(1)(a). The failed Copenhagen Accord had included a temperature target of below 2 degrees Celsius. United Nations Framework Convention on Climate Change, *Report of the Conference of the Parties on its Fifteenth Session*, Dec. 2/CP.15, U.N. Doc. FCCC/CP/2009/11/Add.1 (Mar. 30, 2010), available at <https://unfccc.int/resource/docs/2009/cop15/eng/11a01.pdf>.

87. The Final Report of the structured expert dialogue (2013–2015) was prepared based on face-to-face interviews with over seventy experts. See United Nations Framework on Climate Change, Subsidiary Body for Scientific and Technological Advice, *Report on the Structured Expert Dialogue on the 2013–2015 Review*, ¶ 2, U.N. Doc. FCCC/SB/2015/INF.1 (May 4, 2015), available at <http://unfccc.int/resource/docs/2015/sb/eng/inf01.pdf>. According to the report, experts felt that a temperature-only limit would not address all changes in the climate system resulting from GHG emissions, potentially such as ocean acidification. *Id.* ¶ 20.

88. *Id.* ¶ 42.

89. The Final Report of the Structured Expert Dialogue identified the need for additional research on the relationship between ocean acidification and temperature increase. *Id.* ¶ 120.

demonstrate that even if atmospheric carbon dioxide levels in the atmosphere do not rise above 450 parts per millions, ocean acidification will have profound impacts on many marine systems unless carbon dioxide emissions are reduced by 50 percent.⁹⁰ Due to the fact that carbon dioxide emissions are the only cause of ocean acidification, unless this temperature range is linked directly to anthropogenic concentrations of carbon dioxide, it is questionable that achievement of these temperatures will necessarily result in the decrease in ocean acidification. As observed by Harrould-Kolieb, “any efforts aimed at achieving a warming of no more than 2°C would need to prioritize carbon dioxide reductions over other non-CO₂ gases and in effect preclude a scenario where countries can reduce non-CO₂ greenhouse gases at the expense of carbon dioxide reductions.”⁹¹

The Paris Agreement makes only passing reference to oceans in the preamble, where the Parties note “the importance of ensuring the integrity of all ecosystems, including oceans.”⁹² Echoing the UNFCCC, the preamble also recognizes “the importance of the conservation and enhancement, as appropriate, of sinks and reservoirs of the greenhouse gases referred to in the Convention.”⁹³ In addition, Article 5(1) reiterates the hortatory call to Parties in article 4(1)(d) of the UNFCCC to “take action to conserve and enhance, as appropriate, sinks and reservoirs of greenhouse gases as referred to in Article 4, paragraph 1(d), of the Convention, including forests.”⁹⁴ Implicitly, this includes oceans, but again, it is limited to their role as sinks and reservoirs for the mitigation of greenhouse gases. Despite the critical role oceans play in mitigating the impacts of carbon dioxide emissions, the Paris Agreement, like the Kyoto Protocol, fails to recognize this and instead places its focus on conservation, sustainable management of forests, and enhancement of forest carbon stocks in developing countries.⁹⁵

Another important aspect of the Paris Agreement that distinguishes it from the UNFCCC and the Kyoto Protocol is that it gives adaptation equal status with mitigation, a matter of great importance for the developing country Parties.⁹⁶ Further, Article 2(b) of the Paris Agreement makes express reference to resilience building as part of enhancing the implementation of the UNFCCC to increase the “ability to adapt to the adverse impacts of climate change and foster climate resilience and low greenhouse gas emissions development, in a manner that does not threaten food production.” In addition, adaptation and resilience

90. *IAP Statement on Ocean Acidification*, 12 J. INT’L WILDLIFE L. & POL’Y 210, 212–13 (2009).

91. Harrould-Kolieb, *supra* note 19, at 629.

92. Paris Agreement, *supra* note 84.

93. See Paris agreement, *supra* note 85; UNFCCC, *supra* note 20, at 166.

94. See Paris Agreement, *supra* note 84, at art. 5(1).

95. *Id.* at art. 5(2).

96. U.N. Framework Convention on Climate Change, *Report of the Conference of the Parties on its Eighteenth Session*, U.N. Doc. FCCC/CP/2012/8/Add.1, Decision 1/CP.18 (Feb. 28, 2013), available at <http://unfccc.int/resource/docs/2012/cop18/eng/08a01.pdf> (reaffirming, in Part III, that “adaptation must be addressed with the same priority as mitigation”).

strengthening is addressed in Article 7 where the Parties, taking into account the temperature goal in Article 2, established a global goal to enhance adaptive capacity, strengthen resilience, and reduce vulnerability to climate change.⁹⁷ Article 7(9) also provides for adaptation planning, where each Party commits to include an assessment of climate change impacts and vulnerabilities that will contribute to preparing nationally determined prioritized actions that takes into account vulnerable people, places, and ecosystems.

However, while the UNFCCC does not provide a definition of what adaptation to climate change means, according to the IPCC, adaptation “refers to adjustments in ecological, social, or economic systems in response to actual or expected climatic stimuli and their effects or impacts.”⁹⁸ Given the increased emphasis on adaptation to the adverse impacts of climate change in the Paris Agreement, this raises the question of how Parties will adapt to ocean acidification, which is described as a slow-onslaught event. It is clear that additional studies and work must be undertaken with urgency to examine this critical issue of adaptation to ocean acidification. This will also involve financial commitments under the climate change regime, which can be undertaken under the Loss and Damage Mechanism⁹⁹ or the Green Climate Fund.¹⁰⁰

One of the innovative approaches adopted by the Paris Agreement is the requirement under Article 4(2) for all Parties to submit successive and progressive nationally determined contributions (NDCs) in order to achieve the temperature goals articulated in Article 2.¹⁰¹ However, if as asserted by the International Association of Scientists, at least a 50 percent reduction by 2050 of carbon dioxide emissions is necessary to reverse the impacts of ocean acidification.¹⁰² This will need to be incorporated into the NDCs of States and be part of the global stock to take place every five years in accordance with Article 15.¹⁰³ Intended Nationally Determined Contributions (INDCs) as submitted pursuant to Decision 1/CP.20 provide the current foundation for NDCs. In relation to adaptation, in addition to laying out domestic mitigation measures in their INDCs, Parties were also invited to include measures they intend to adopt for adaptation purposes. However, as the NDCs that are to be

97. See Paris Agreement, *supra* note 85, at art. 7(1).

98. INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, CLIMATE CHANGE 2001: IMPACTS, ADAPTATION, AND VULNERABILITY 879 (2001).

99. The Warsaw International Mechanism for Loss and Damage was established in 2013 at the Conference of the Parties meeting held in Warsaw. U.N. Framework Convention on Climate Change, *Report of the Conference of the Parties on its Nineteenth Session*, U.N. Doc. FCCC/CP/2013/10/Add.1, Decision 2/CP.19 (Jan. 31, 2014).

100. The Green Climate Fund was established in 2010 as the operating entity of the Financial Mechanism of the Convention during the Conference of the Parties meeting held in Cancun. *Report of the Conference of the Parties on its Sixteenth Session*, *supra* note 68, ¶ 102.

101. Paris Agreement, *supra* note 84, at art. 4(2). However, under Article 4(6) the least developed countries and small island developing States may prepare and communicate strategies, plans, and actions for low greenhouse gas emissions development reflecting their special circumstances. *Id.* at art. 4(6).

102. See IAP Statement on Ocean Acidification, *supra* note 90, at 212–13.

103. *Id.*

submitted in accordance with Articles 3 and 4 of the Paris Agreement are tied to the atmospheric temperature goal in Article 2, it remains unknown how adaptation measures relating to ocean acidification will fit into this. It is unclear if and how NDCs can be used to address ocean acidification.

The Paris Agreement represents a major shift in the approach of the UNFCCC climate change regime. First, the requirement for taking mitigation measures applies to all Parties.¹⁰⁴ Second, it provides a balanced approach between mitigation and adaptation.¹⁰⁵ Third, it is based on the self-differentiation approach that defers to the Parties to determine their own pathway toward reducing the increase in the global temperature based upon their own developmental needs through the preparation of NDCs, which can also include adaptation measures. Fourth, the Paris Agreement has no end date, and until agreed otherwise it will provide the principal framework for addressing climate change indefinitely.

Accepting that ocean acidification is a problem caused by excessive emissions of anthropogenic carbon dioxide, the Paris Agreement arguably provides the framework for adopting direct measures that target the very source of acidification and are not simply palliative. Moreover, such measures should go beyond the goal of enhancing the capacity of oceans to serve as sinks or reservoirs for carbon dioxide but include measures to address ocean acidification as an adverse impact.

II. LAW OF THE SEA

A. *United Nations Convention on the Law of the Sea*

UNCLOS is the principal global agreement for regulating all activities in the oceans.¹⁰⁶ Negotiated in the 1970s and adopted in 1982, Part XII of the UNFCCC provided the first overarching global instrument for the protection and preservation of the marine environment. At the time, the major threat to the oceans came from traditional pollution sources, such as land-based dumping and shipping discharges. Because it was negotiated before the impacts of climate change were well known,¹⁰⁷ climate change did not figure among the threats to the marine environment and therefore Part XII does not make mention of ocean acidification.¹⁰⁸ It is an open question, however, if, despite this, Part XII still provides a legal foundation upon which ocean acidification can be addressed.

104. See Paris Agreement, *supra* note 84, at arts. 3, 4.

105. *Id.*

106. United Nations Convention on the Law of the Sea, Dec. 10, 1982, 1833 U.N.T.S. 397 [hereinafter UNCLOS].

107. Robin Churchill, *The LOSC Regime for Protection of the Marine Environment — Fit for the Twenty-First Century?*, in RESEARCH HANDBOOK ON INTERNATIONAL MARINE ENVIRONMENTAL LAW 3, 29 (Rosemary Rayfuse ed., 2015).

108. UNCLOS, *supra* note 106, at Part XII.

Carbon dioxide may meet the definition of “pollution” under Article 1(1)(4) of UNCLOS, which is defined as “the introduction by man, directly or indirectly, of substances or energy into the marine environment, which results or is likely to result in such deleterious effects as harm to living resources and marine life, hazards to human health.”¹⁰⁹ Ocean acidification is the direct consequence of ocean absorption of atmospheric carbon dioxide, which would make carbon dioxide a substance or energy that is directly or indirectly introduced by human activities into the marine environment. More importantly, there is significant scientific evidence showing the absorption of the excessive anthropogenic concentration of atmospheric carbon dioxide by the oceans has negative effects on marine living resources and other marine life.¹¹⁰

Consequently, according to Article 194(1), States are required, *inter alia*, to take all measures, either individually or jointly, necessary to prevent, reduce, and control pollution of the marine environment from any source. Such measures need to be consistent with UNCLOS.¹¹¹

Furthermore, as explained by the International Tribunal for the Law of the Sea, the use of the language “to ensure” creates an obligation of due diligence. For example, Article 194(2) obligates States to take all the necessary measures to ensure that activities under their jurisdiction or control are so conducted as to not cause damage by pollution to other States and their environment.¹¹² Due diligence means an obligation to adopt the appropriate rules and measures, exercise vigilance in their enforcement, and also monitor the activities of private and public operators.¹¹³ It also includes “an obligation to deploy adequate means, to exercise best possible efforts, to do the utmost, to obtain. . .” the required result.¹¹⁴ It is an interesting question as to what extent the due diligence obligation of States extends to prevention of the excessive emission of atmospheric concentrations of carbon dioxide from activities under their control. This would presumably extend to land-based activities and private actors. According to Boyle, States have a due diligence obligation under Article 194 to

109. *Id.*; see also Alan Boyle, *Law of the Sea Perspectives on Climate Change*, 27 INT’L J. MARINE & COASTAL L. 831, 832–33 (2012); Alan Boyle, *Climate Change, Ocean Governance and UNCLOS, in LAW OF THE SEA: UNCLOS AS A LIVING TREATY* 211, 217 (Jill Barrett & Richard Barns eds., 2016).

110. See Ligia B. Azevedo et al., *Calcifying Species Sensitivity Distributions for Ocean Acidification*, 49 ENV’T L. SCI. & TECHNOL. 1495, 1495 (2015); Scott C. Doney, *supra* note 7, at 235–36; SECRETARIAT OF THE CONVENTION ON BIOLOGICAL DIVERSITY, *supra* note 50, at 7–9.

111. UNCLOS, *supra* note 106, at art. 194(1).

112. See Responsibilities and Obligations of States Sponsoring Persons and Entities with Respect to Activities in the Area (No. 17), Case No. 17, Advisory Opinion of Feb. 1, 2011, ITLOS Rep. 10, ¶ 107–113 [hereinafter Seabed Advisory Opinion].

113. See Pulp Mills on the River Uruguay (Arg. v. Uru.), Judgment, 2010 I.C.J. Rep. 14, ¶ 197 (Apr. 20) [hereinafter Pulp Mills Case]; Seabed Advisory Opinion, *supra* note 112, ¶ 115 (citing the Pulp Mills Case); Request for an Advisory Opinion submitted by the Sub-Regional Fisheries Commission (SRFC) (No. 21), Case No. 21, Advisory Opinion of Apr. 1, 2015, ITLOS Rep. 4, ¶ 131 [hereinafter SRFC Advisory Opinion] (citing Pulp Mills Case, *supra* note 113).

114. See Seabed Advisory Opinion, *supra* note 112, ¶ 110; SRFC Advisory Opinion, *supra* note 113, ¶ 129 (citing Seabed Advisory Opinion, *supra* note 112).

regulate and control activities such as carbon dioxide emitting power generators that use oil or coal, oil extraction industries, coal-mining, or possibly deforestation.¹¹⁵

Scientific information on the impacts of ocean acidification are relatively new and more research is clearly needed. However, existing data show that fragile ecosystems and habitats such as coral reefs are directly impacted, bringing into application Article 194(5) of UNCLOS on the obligation to protect rare or fragile ecosystems and the habitat of depleted, threatened, or endangered species and other forms of marine life.¹¹⁶

Moreover, Article 192 imposes a clear obligation on States to protect and preserve the marine environment, without any mention of pollution.¹¹⁷ In the recent South China Sea Arbitral Award, the Tribunal provided a detailed interpretation of Article 192.¹¹⁸ The Tribunal explained that first the obligation to “protect” the marine environment means protection from *future* damage and to “preserve” means to *maintain* or *improve* the existing condition of the marine environment.¹¹⁹ Furthermore, the Tribunal stated that these two elements included the obligation to take *active* measures and to prevent the degradation of the existing marine environment.¹²⁰ How would this apply to ocean acidification? It would mean that States are required to take active measures to prevent further degradation, to improve existing conditions, and to ultimately protect against future damages. The challenge is that ocean acidification, with the exception of emissions from shipping, is the symptom of atmospheric emissions from activities that take place on land rather than at sea. Whether ocean acidification is essentially land-based pollution, atmospheric pollution, or both may be debatable, but for purposes of UNCLOS, States have clear obligations to adopt laws and regulations to prevent, reduce, and control pollution of the marine environment from land-based sources, under Article 207,¹²¹ or from atmospheric sources under Article 212.¹²²

It is fair to conclude that in light of the scientific evidence on the harm to the marine environment, in particular fragile ecosystems and habitats, States have an obligation under UNCLOS to adopt the necessary laws, rules, and measures to prevent, reduce, and control the emissions of carbon dioxide from all sources that are causing ocean acidification.

What steps are required to meet this obligation, however, is an open question. Carbon dioxide emissions are for the most part the result of land-based activities and thus it ultimately falls upon individual State Parties to adopt the

115. Boyle, *supra* note 109, at 833.

116. UNCLOS, *supra* note 106, at art. 194(5).

117. *Id.* at art. 192.

118. S. China Sea Arb. (Phil. v. China), PCA Case Repository 2013–19 (Perm. Ct. Arb. 2016).

119. *Id.* ¶ 941.

120. *Id.*

121. UNCLOS, *supra* note 106, at art. 207.

122. *Id.* at art. 212.

necessary laws and regulations that would prevent, reduce, and control ocean-acidification producing emissions. However, any meaningful action to mitigate ocean acidification would require collective action. Unlike the climate change regime, UNCLOS does not have a mechanism to adopt decisions of the Parties for collective actions and measures. The only option available would be for Parties to adopt a separate implementing agreement. Such an agreement could be specifically for ocean acidification, or it could be incorporated into the process that is already under way for the possible adoption of an internationally legally binding instrument for the conservation and sustainable use of biological diversity in areas beyond national jurisdiction, as discussed below.

B. The Internationally Legally Binding Instrument for the Conservation and Sustainable Use of Biological Diversity in Areas Beyond National Jurisdiction

In 2015, the United Nations General Assembly adopted a decision to develop an international legally binding instrument (ILBI) under UNCLOS on the conservation and sustainable use of marine biological diversity in areas beyond national jurisdiction.¹²³ The decision established a preparatory committee (Prep Com) to examine specific issues and make substantive recommendations to the General Assembly on the elements of a draft text of an ILBI under the Convention for the General Assembly.¹²⁴ Climate change had been identified early on by the Ad Hoc Open-ended Informal Working Group¹²⁵ as an area of concern for oceans and biodiversity.¹²⁶ During the four sessions of the Prep Com held between 2015 and 2016, the question of climate change and oceans was discussed. Ocean acidification was specifically raised in relation to ocean resilience and areas-based management tools and marine protected areas.¹²⁷ The Final Report of the Preparatory included a general reference to

123. G.A. Res. 69/292 (June 19, 2015).

124. *Id.*

125. See G.A. Res. 59/24, ¶ 73, Oceans and the Law of the Sea (Nov. 17, 2004).

126. G.A. Doc. A/63/79, Report of the Ad Hoc Open-ended Informal Working Group to study issues relating to the conservation and sustainable use of marine biological diversity beyond areas of national jurisdiction: Letter dated May 15, 2008 from the Co-Chairpersons of the Ad Hoc Open-ended Informal Working Group to Study Issues relating to the Conservation and Sustainable Use of Marine Biological Diversity Beyond Areas of National Jurisdiction addressed to the President of the General Assembly (May 16, 2008).

127. See PSIDS Submission to the Second Meeting of the Preparatory Committee for the Development of an International Legally Binding Instrument under the United Nations Convention on the Law of the Sea on the Conservation and Sustainable Use of Marine Biological Diversity of Areas Beyond National Jurisdiction 2.2 (Aug. 2016), available at http://www.un.org/depts/los/biodiversity/prepcom_files/rolling_comp/PSIDS_second.pdf; Written Submission of the EU and its Member States: Area-Based Management Tools, Including MPAs (Dec. 14, 2016), available at http://www.un.org/depts/los/biodiversity/prepcom_files/rolling_comp/European_Union-area-based_management_tools.pdf; Submission by IUCN Following the Second Session of the Preparatory Committee on the Development of an International Legally Binding Instrument Under the United Nations Convention on the Law of the Sea on the Conservation and Sustainable Use of Marine Biological Diversity of Areas Beyond National Jurisdiction 3 (Dec. 5, 2016), available at http://www.un.org/depts/los/biodiversity/prepcom_files/rolling_comp/IUCN.pdf; Alliance Of Small Island States (AOSIS)

building resilience to the effects of climate change as one of its recommendations.¹²⁸

There are, however, limitations with the potential ILBI in relation to tackling ocean acidification, which is principally caused by land-based activities.¹²⁹ As it stands, the potential ILBI has five main components: marine genetic resources (including questions on the sharing of benefits), measures such as area-based management tools (including marine protected areas), environmental impact assessments, capacity building, and the transfer of marine technology.¹³⁰ During the Prep Com meetings, climate change was generally raised in the context of impact assessments and ocean acidification was raised in the context of building ocean resilience through the establishment of marine protected areas.¹³¹ There is no question that climate change, which adversely impacts marine life and biological diversity, must be addressed under any future instrument on conservation and sustainable use of biological diversity in areas beyond national jurisdiction. However, currently, the recommendations adopted by consensus by the Prep Com provide only palliative measures in relation to ocean acidification. They do not provide measures to prevent, control, or reduce the cause of anthropogenic emissions of carbon dioxide from land-based activities. Any meaningful contribution by any future ILBI would have to be able to either establish, or at least have some linkage to, reduction targets of carbon dioxide that would significantly reduce the current pH level causing ocean acidification. Environmental impact assessments can certainly play a role by requiring the inclusion of ocean acidification consequences; however, whether this alone would be adequate without other concomitant mitigation measures requires further study.

CONCLUSION

Baird, Simons, and Stephens were correct to characterize the problem of ocean acidification as existing in a legal twilight zone. It is an issue that appears to fall between the cracks of the two principal regimes for climate change, the UNFCCC and ocean governance under UNCLOS. What then are the options

Submission at the End of the Third Session of the Preparatory Committee on the Development of an International Legally Binding Instrument Under the United Nations Convention on the Law of the Sea on the Conservation and Sustainable Use of Marine Biological Diversity (Apr. 24, 2017), available at http://www.un.org/depts/los/biodiversity/prepcom_files/streamlined/AOSIS.pdf.

128. Report of the Preparatory Committee Established by General Assembly Resolution 69/292: Development of an International Legally Binding Instrument under the United Nations Convention on the Law of the Sea on the Conservation and Sustainable Use of Marine Biological Diversity of Areas Beyond National Jurisdiction, U.N. Doc. A/AC.287/2017/PC.4/2, at 9 (July 31, 2017), available at http://www.un.org/ga/search/view_doc.asp?symbol=A/AC.287/2017/PC.4/2.

129. See *id.*; G.A. Res. 69/292, *supra* note 123.

130. Report of the Preparatory Committee Established by General Assembly Resolution 69/292, *supra* note 127, at 2.

131. *Id.*

available? A stand-alone new agreement or incorporation into existing instruments?

Ocean acidification is not addressed under the existing climate change regime of the UNFCCC, Kyoto Protocol as amended, or the Paris Agreement. However, this does not mean it cannot be in the future. The much-anticipated IPCC assessment report on oceans and the cryosphere promises to include important scientific information that can provide the scientific foundation for taking future legal and policy measures to incorporate ocean acidification into the existing regime. This can occur through the adoption of a mechanism or collective program similar to the treatment of forests in REDD and REDD+, or, as some have suggested, through the adoption of an entirely new instrument. The latter option of a new instrument presents a host of obstacles, including the fact that because the Paris Agreement was freshly negotiated and the Kyoto Protocol amendments have not yet been brought to life, there may be little political appetite for a new agreement.

As the overarching convention for the oceans, UNCLOS seems to provide a strong legal foundation to address ocean acidification as a pollution caused effect of human activities. The obligations of the Parties to prevent, reduce, and control pollution from all sources, including land-based activities, is well established. This obligation has been further articulated by several judgments of the International Tribunal for the Law of the Sea, the International Court of Justice, and arbitration tribunals, including due diligence obligations. However, while UNCLOS lays the foundation for individual State action, it does not by itself provide for the framework for taking the collective action needed for a significant reduction in carbon dioxide emissions, as the UNFCCC regime does through decisions of the Parties. Under UNCLOS, a separate implementing agreement would be necessary. The ongoing process to develop a possible ILBI for the conservation and sustainable use of biological diversity under UNCLOS offers possibilities, but the current scope of the terms of reference is limited to area-based management, impact assessment, benefit sharing for marine genetic resources, capacity building, and technology transfer. This scope provides for the creation of a more palliative rather than preventive measure. Arguably, impact assessments can play a preventive role, but absent clear mitigation targets for carbon dioxide emissions linked to pH levels, it is difficult to gauge the overall impact the inclusion of ocean acidification as part of the criteria for impact assessments will have.

Under the existing international legal framework, as concluded by other authors, the UNFCCC regime appears to provide the more suitable framework for the collective action necessary to mitigate emissions of carbon dioxide causing ocean acidification. First, the IPCC must provide the necessary scientific information that can translate the necessary reduction in carbon dioxide emissions and time framework to have an impact on level of pH balance in the oceans. This can serve as the basis for the Parties to possibly adopt a decision establishing carbon dioxide emission reduction limits and time frame. Second,

the decision could be adopted under either the UNFCCC or by a Meeting of the Parties (MOP) under the Paris Agreement for Parties to include in the next term of NDCs to be submitted by the Parties and evaluated under the global stock take. Furthermore, these actions should be strengthened by including ocean acidification within the mandate of an ILBI, especially as part of the criteria to be adopted for an impact assessment process under the instrument.

We welcome responses to this Article. If you are interested in submitting a response for our online journal, *Ecology Law Currents*, please contact cse.elq@law.berkeley.edu. Responses to articles may be viewed at our website, <http://www.ecologylawquarterly.org>.