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

Nilufer Oral*

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

DOI: https://doi.org/10.15779/Z38SB3WZ68
Copyright © 2018 Regents of the University of California

* Nilufer Oral is a member of the law faculty at Istanbul Bilgi University. She is also a member of the United Nations International Law Commission and a Distinguished Fellow at the Law of the Sea Institute at UC Berkeley Law.
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

---

2. Id.
3. Id. at 40.
4. Id. at 47–48.
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.\textsuperscript{10} The pH balance of the oceans, which for millions of years remained stable, has entered a phase of decrease.\textsuperscript{11}

The impacts of this acidification of the oceans are far-reaching and complex.\textsuperscript{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.\textsuperscript{13} Deep-sea coral reefs may be some of the most vulnerable ecosystems to ocean acidification.\textsuperscript{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.\textsuperscript{15} Acidification will have direct impacts on a wide range of marine organisms that build shells from calcium carbonate.\textsuperscript{16} Key links in food webs are especially vulnerable in polar, sub-polar, deep sea, and upwelling regions.\textsuperscript{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.\textsuperscript{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.”\textsuperscript{19} For example, the existing legal regime under the United Nations Framework Convention on Climate Change (UNFCCC)\textsuperscript{20} is not limited to addressing carbon

\begin{thebibliography}{99}
\bibitem{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. \textit{See} MORITZ BOLLMA\textsc{\textsuperscript{n}} ET AL., \textsc{\textit{WORLD OCEAN REVIEW}} 44–47 (2010).
\bibitem{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 CO\textsubscript{2} to the surface ocean.”). \textit{See} id. at 529.
\bibitem{12} \textit{See} BOLLMA\textsc{\textsuperscript{n}} ET AL., supra note 10, at 36–43.
\bibitem{13} IPCC FIFTH REPORT, supra note 5, at 13.
\bibitem{15} Scott C. Doney et al., \textit{Ocean Acidification: The Other CO\textsubscript{2} Problem, 6 WASH. J. ENVTL. L. & POL’Y} 213, 218–29 (2016).
\bibitem{16} \textit{Id.}
\bibitem{17} Turley, supra note 14, at 207, 213.
\bibitem{19} Ellycia R. Harrould-Kolieb, \textit{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 & Dorothee Herr, \textit{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).
\end{thebibliography}
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

---

23. *Id.*
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)

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, which is defined as “the totality of the atmosphere, hydrosphere, biosphere and geosphere and their interactions.” 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. 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... 


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 . . . “

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. 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.

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. 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. 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. However, others suggest that the overall stabilization of greenhouse gases under the UNFCCC is broad enough to include ocean acidification. 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.

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

32. UNFCCC, supra note 20, at 166.
33. Id. at art. 2.
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.
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. While oceans may fall within the definition of the climate system, 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. 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.” 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. It provides, in part, that developed country Parties should take the lead in combating climate change and the adverse effects thereof. 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.” While some scholars...
interpret adverse effects to exclude ocean acidification, this definition does seem broad enough to encompass ocean acidification. 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.

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. 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. There is evidence that developing countries in specific regions of the world, such as the South Pacific, will be particularly vulnerable to ocean acidification. 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.” 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 2013 and included in the 2015 Paris Agreement?

49. UNFCCC, supra note 20, at art. 1(1).
51. See UNFCCC, supra note 20, at art. 4(8).
52. Id. at art. 4(4).
54. UNFCCC, supra note 20, at art. 3(3).
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. 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.” 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.” 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. 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.

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. 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.”

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-REDD and REDD+ programs. 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. 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. The Subsidiary Body for Scientific and Technological Advice recognized ocean acidification as an emerging issue and highlighted the need for more research. Still, mention of the impact of climate change on the ocean only appeared in a footnote in the 2010 Cancun

66. Harrould-Kolieb, supra note 19, at 617.
Agreements. 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, the prominent role displayed at the first United Nations Conference on the Oceans held in June 2017, 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. 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. 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.” 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.

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. There is a notable focus on forests in the Kyoto Protocol, whereas, unlike under the UNFCCC, no express mention is made to

---

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. 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.

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. 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. 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. 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. 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. As of 2017, a gap remains to attain the 144 ratifications required for the Doha amendment to enter into effect.

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).
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. 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. 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.” It remains unclear what impact these temperature objectives will have on ocean acidification. The achievement of these temperature targets 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.

Although, the same report noted that with a temperature increase of 2°C the risks of ocean warming and acidification would become high.

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 levels in the oceans. This is a critical issue that requires additional scientific data and study, especially in light of data that

---


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


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. 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.”

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.” 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.” 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 referred to in Article 4, paragraph 1(d), of the Convention, including forests.” 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.

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. 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

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).
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.\textsuperscript{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.”\textsuperscript{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-onset 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 Mechanism\textsuperscript{99} or the Green Climate Fund.\textsuperscript{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.\textsuperscript{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,\textsuperscript{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.\textsuperscript{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

\begin{footnotes}
\item[97] See Paris Agreement, supra note 85, at art. 7(1).
\item[98] \textsc{Intergovernmental Panel on Climate Change}, \textit{Climate Change 2001: Impacts, Adaptation, and Vulnerability} 879 (2001).
\item[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. \textit{Report of the Conference of the Parties on its Sixteenth Session}, supra note 68, ¶ 102.
\item[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).
\item[102] See \textit{IAP Statement on Ocean Acidification}, supra note 90, at 212–13.
\item[103] Id.
\end{footnotes}
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


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.
[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.” 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.

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.

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. 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. It also includes “an obligation to deploy adequate means, to exercise best possible efforts, to do the utmost, to obtain...” the required result. 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

---

111. *UNCLOS, supra* note 106, at art. 194(1).
regulate and control activities such as carbon dioxide emitting power generators that use oil or coal, oil extraction industries, coal-mining, or possibly deforestation.\textsuperscript{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.\textsuperscript{116}

Moreover, Article 192 imposes a clear obligation on States to protect and preserve the marine environment, without any mention of pollution.\textsuperscript{117} In the recent South China Sea Arbitral Award, the Tribunal provided a detailed interpretation of Article 192.\textsuperscript{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.\textsuperscript{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.\textsuperscript{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,\textsuperscript{121} or from atmospheric sources under Article 212.\textsuperscript{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

\begin{footnotesize}
\begin{enumerate}
\item Boyle, supra note 109, at 833.
\item UNCLOS, supra note 106, at art. 194(5).
\item Id. at art. 192.
\item Id. ¶ 941.
\item Id.
\item Id.
\item UNCLOS, supra note 106, at art. 207.
\item Id. at art. 212.
\end{enumerate}
\end{footnotesize}
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. 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. Climate change had been identified early on by the Ad Hoc Open-ended Informal Working Group as an area of concern for oceans and biodiversity. 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. The Final Report of the Preparatory included a general reference to

---

124. Id.
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


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


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.