Climate Mitigation, Adaptation, and the UN Convention on the Law of the Sea

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CHAPTER 10

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1. Introduction

The ocean is the blue heart of our planet. It covers more than 70 percent of the Earth's surface, is home to an incredible diversity of marine organisms and produces over half of the world's oxygen. Without it, the Earth would not exist as we know it. The ocean also plays a crucial role in regulating our planet's climate, having taken up approximately 40 percent of anthropogenically-sourced CO_2 from the atmosphere since the beginning of the industrial revolution and becoming the main store of CO_2.[1] Yet bearing the brunt of reducing global warming has come at a heavy price. This large-scale absorption of CO_2 emissions has led to ocean warming, ocean acidification, sea-level rise, the melting of sea ice and glaciers, and increased vulnerability of marine biodiversity.[2]

The UN Convention on the Law of the Sea 1982 (LOSC)[3] has been famously described as a constitution for the oceans. It establishes rules governing all matters relating to the uses and protection of the ocean and its resources and sets out several maritime zones in which these rules operate. At its inception, the LOSC was viewed as a 'new legal order for the seas',[4] which would facilitate the 'study, protection and preservation of the marine environment'.[5] Yet despite the critical impacts of climate change on the ocean, the LOSC does not regulate activities for the *specific* purpose of preventing the negative effects of climate change. In fact, it does not refer to climate change at all. At the time of the LOSC's conclusion, there was little appreciation of the impacts of climate change on the ocean and this comes through in the text.[6] Nevertheless, the LOSC remains a key regime given its importance to the regulation of the marine environment; Agenda 21 recognises the LOSC as 'providing the legal basis upon which to pursue the protection and sustainable development of the marine and coastal environment and its resources.'[7]

This Chapter aims to stress test the LOSC in the context of climate change challenges. It first outlines the oceanic impacts of climate change before examining whether the LOSC creates obligations to mitigate greenhouse gas (GHG) emissions to protect the marine environment. It also analyses the LOSC in the context of climate adaptation, examining whether it supports adaptation strategies that address threats to marine biodiversity.[8]

2. Oceanic Impacts of Climate Change

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[1] Philip C Reid et al., 'Impacts of the Ocean on Climate Change' in David W Sims (ed.), *Advances in Marine Biology* (Vol 56, Elsevier 2009) 1.

[2] Malin L Pinsky et al., 'Greater vulnerability to warming of marine versus terrestrial ectotherms' (2019) 569 Nature 108.

[3] United Nations Convention on the Law of the Sea (adopted 10 December 1982, entered into force 16 November 1994) 1833 UNTS 396 (LOSC).

[4] 60th Plenary Meeting, UN Doc A/CONF.62/SR.60 (1976), Third United Nations Conference on the Law of the Sea Official Records (Off Rec) para 3; LOSC, Preamble.

[5] LOSC, Preamble.

[6] Tim Stephens, 'Warming Waters and Souring Seas: Climate Change and Ocean Acidification' in Donald R Rothwell, Alex G Oude Elferink, Karen Scott and Tim Stephens (eds), *The Oxford Handbook of the Law of the Sea* (Oxford University Press 2015) 777.

[7] Report of the UN Conference on Environment and Development, Chapter 17.1, 238, UN Doc A/CONF 151/26/Rev.1 (Vol 1) (12 August 1992).

[8] For a detailed discussion of the implications of climate change for marine protected areas and fisheries laws, see Chapters 6 and 9 in this Volume.

The impact of global warming on the ocean is unequivocal. The Intergovernmental Panel on Climate Change (IPCC)'s First Assessment Report (AR1) concluded in 1990 that it was highly likely that sea levels have been rising over the last 100 years.[9] Even at that early stage in assessment, future sea level and temperature rises were considered to be unavoidable, even with substantial decreases in GHG emissions.[10] In 2016, the IPCC published a Special Report on the Ocean and the Cryosphere in a Changing Climate, which recognised the changes to the ocean and cryosphere as 'pervasive'[11] and that climate risks by the end-of-century would be even greater under high greenhouse gas emission scenarios.[12] The IPCC's Sixth Assessment Report in 2021 (AR6)[13] confirmed that many changes in the oceans and ice sheets will be irreversible for centuries to millennia due to past and future GHG emissions,[14] and even if warming can be kept well below 2°C, societies will be exposed and challenged to adapt.[15]

2.1 Ocean Acidification

The ocean has historically had a relatively alkaline composition.[16] Ocean acidification, sometimes called 'climate change's equally evil twin',[17] refers to the lowering of the average pH, making the ocean more acidic. This is mainly caused by the absorption of CO_2 from the atmosphere.[18] Studies show that the ocean has taken up between 20-30 percent of the total carbon released by humanity since the 1990s,[19] and since the beginning of the industrial era, ocean acidity has increased by 26 percent.[20] Makomere's Chapter 11 in this Volume addresses the issue of ocean acidification in greater detail.

It is expected that continued acidification will lead to the significant alteration of marine ecosystems and the loss of biodiversity. When CO_2 dissolves in seawater, resultant chemical reactions increase the concentration of hydrogen ions, which reduces carbonate ions in the ocean. These ions are key components for calcifying organisms,[21] such as corals, molluscs and crustaceans, which build their shells and skeletons from calcium and carbonate. This directly impacts these species' survival, with research predicting that the skeletal density of some corals could decline by up to 20.3 percent during this century.[22] A well-known example is the Great

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[9] Intergovernmental Panel on Climate Change (IPCC), *Climate Change: The IPCC Scientific Assessment (AR1)*, (Cambridge University Press 1990) Ch 9, 263, available at <https://www.ipcc.ch/site/assets/uploads/2018/03/ipcc_far_wg_I_full_report.pdf>.

[10] ibid 278.

[11] IPCC, *Special Report on the Ocean and Cryosphere in a Changing Climate (SROCCC), Technical Summary* (2019) 43, available at <https://www.ipcc.ch/site/assets/uploads/sites/3/2019/11/04_SROCC_TS_FINAL.pdf>

[12] ibid 45.

[13] IPCC, *Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change (AR6)* (Cambridge University Press 2021), available at <https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_Full_Report.pdf> (accepted version, subject to final edits at time of writing).

[14] ibid, *AR6 Summary for Policymakers* 28.

[15] IPCC, *SROCCC Technical Summary* (n 11) 45.

[16] UN Secretary General, *Oceans and the Law of the Sea: Report of the Secretary General*, UN Doc A/68/71 (2013) 6.

[17] See Carles Pelejero et al, 'Paleo-perspectives on ocean acidification' (2010) 25(6) Trends in Ecology & Evolution 332.

[18] Ken Caldeira and Michael E Wickett, 'Anthropogenic carbon and ocean pH' (2003) 425 Nature 365.

[19] IPCC, *SROCCC Technical Summary* (n 11) 59.

[20] IPCC, *Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change (AR5)* (Cambridge University Press 2013) 41.

[21] Gretchen E Hoffman et al., 'The Effect of Ocean Acidification on Calcifying Organisms in Marine Ecosystems: An Organism-to-Ecosystem Perspective' (2010) 41 Annual Review of Ecology, Evolution, and Systematics 127.

[22] Nathaniel R Mollica et al., 'Ocean acidification affects coral growth by reducing skeletal density' (2018) 115(8) Proceedings of the National Academic of Sciences of the United States of America 1754.

Barrier Reef, where acidification is already playing a role in its rapidly changing condition.[23] The world heritage site is on the verge of becoming the first to be placed on the List of World Heritage in Danger due to climate change and ocean acidification,[24] with the long-term outlook for the site's ecosystem having deteriorated from poor to very poor.[25]

2.2 Ocean Warming

The absorption of excess CO_2 and heat generated by GHG emissions also causes ocean temperatures to increase. The IPCC's Fifth Assessment Report (AR5) states that the ocean has persistently warmed since 1971, taking up more than 90 percent of excess heat in the climate system,[26] in contrast with the atmosphere which has stored only about one percent of the energy accumulated.[27] Sea temperature rise reached a record high in 2021,[28] exacerbated by wide-spread oceanic heatwaves. Heatwaves have a multiplier effect and when they occur on top of background warming, many marine species and communities cannot adapt to the superheated marine conditions, pushing some beyond their limit to survive. This warming contributes to changes in the biogeography and community composition of marine organisms and alters interactions between organisms.[29] The Great Barrier Reef, noted above, has already been the subject of several mass coral bleaching events.[30] The primary cause of such events is rising ocean temperatures, putting corals under heat stress and causing them to expel zooxanthellae, turning them white and making them vulnerable to starvation and disease.

Ocean warming also results in a shrinking cryosphere. Between 1970 and 2017, the Southern Ocean below the 30th parallel south accounted for 35-43 percent of the global ocean heat gain in the upper 2000m, even though it accounts for just 25 percent of the global ocean area.[31] This causes habitat contraction and increases pressure on polar species, also resulting in the loss of breeding grounds for fish and mammals. It also leads to species shifts and habitat displacement both for smaller species that can no longer tolerate high temperatures, and apex species that must follow their prey into new areas.

2.3 Sea-level rise

As seawater warms, it also expands. Together with added water from melting ice sheets and glaciers, this causes rising sea levels. Thwaites Glacier loses approximately 50 billion tonnes of ice each year and causes four percent of global sea-level rise.[32] Fractures can clearly be seen in the glacier's unstable eastern shelf, and if the entire glacier collapses, it could raise global sea levels by more than 50cm.[33] AR6 confirmed that between 1901 and 2018, global mean sea

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[23] Katharina E Fabricius et al., 'Progressive seawater acidification on the Great Barrier Reef continental shelf' (2020) 10 Nature Scientific Reports 18602.
[24] UNESCO Convention Concerning the Protection of the World Cultural and Natural Heritage, World Heritage Committee, Extended 44th Session 16-31 July 2021, WHC/21/44.COM/7B.Add, 83-7.
[25] ibid 86.
[26] IPCC, *AR5* (n 20) 40.
[27] ibid.
[28] Lijing Cheng et al., 'Another record: Ocean Warming Continues through 2021 despite La Niña Conditions' (2022) Advances in Atmospheric Sciences, available at <https://link.springer.com/article/10.1007/s00376-022-1461-3>.
[29] IPCC, *SROCCC Technical Summary* (n 11) 61.
[30] UNESCO World Heritage Committee, 44th Session (n 24).
[31] IPCC, *SROCCC Technical Summary* (n 11) 52.
[32] Alexandra Witze, 'Giant cracks push imperilled Antarctic glacier closer to collapse' (*Nature News*, 14 December 2021), available at <https://www.nature.com/articles/d41586-021-03758-y>.
[33] Jeff Tollefson, 'First look under imperilled Antarctic glacier finds 'warm water coming from all directions' (*Nature News*, 20 February 2020), available at <https://www.nature.com/articles/d41586-020-00497-4>.

level rose by 20cm, with the average rate of sea-level rise being 3.7mm per year between 2006 and 2018, more than triple the average between 1901 and 1971.[34]

Rising sea levels are having, and will continue to have, a catastrophic effect on low lying islands. They are already seeing flooding, destruction of crops, high tides and the gradual loss of land territory, but many states, such as Kiribati, the Maldives, and the Marshall Islands, could disappear altogether.[35] This puts thousands of lives at risk and forces the migration of many more. The 2021 Agreement for the Establishment of the Commission of Small Island States on Climate Change and International Law acknowledges the devastating impact for small island states.[36]

3. Climate Mitigation and the LOSC

Mitigation refers to efforts to reduce or stabilize[37] emissions of GHGs into the atmosphere to prevent the adverse effects of climate change. There is a general duty towards climate mitigation in the LOSC, given that states have an obligation to 'protect and preserve' the marine environment in Article 192. The tribunal in the *South China Sea Arbitration* interpreted this as the '"protection" of the marine environment from future damage and "preservation" in the sense of maintaining or improving its present condition.'[38] This is arguably the goal of mitigation. The tribunal also stated that Article 192 includes a 'positive obligation to take active measures to protect and preserve the marine environment, and by logical implication, entails the negative obligation not to degrade the marine environment.'[39] Clearly, there is overwhelming evidence that GHGs do degrade the marine environment.

Article 192 is also informed by the other provisions of Part XII LOSC.[40] Article 194(1) requires states to take all necessary measures consistent with the LOSC 'to prevent, reduce and control pollution of the marine environment from any source.' This is further acknowledgment of a broad duty to mitigate. However, given that the LOSC itself does not include any standards, reduction targets or timetables, it is difficult to assess whether states have met or breached these obligations. In determining the extent of the duty, several points are examined below including the concepts of 'marine environment' and 'pollution'.

3.1 What is the 'marine environment'?

The marine environment, although not explicitly defined in the LOSC, includes 'rare or fragile ecosystems as well as the habitat of depleted, threatened or endangered species and other forms of marine life.'[41] In practice, a very broad definition has been adopted in jurisprudence, policy and treaty-making. In Agenda 21, the marine environment is defined as 'including the oceans

[34] IPCC, *AR6 Summary for Policymakers* (n 13) 5.
[35] One of the necessary criteria for statehood is a 'defined territory', Convention on the Rights and Duties of States (adopted 26 December 1933, entered in force 26 December 1934) 165 LNTS 19 (Montevideo Convention) Art 1.
[36] Agreement for the Establishment of the Commission of Small Island States on Climate Change and International Law (COSIS) (adopted 31 October 2021), available at <https://cpij-pcji.ca/wp-content/uploads/2021/11/Agreement-for-the-establishment-of-COSIS.pdf>.
[37] United Nations Framework Convention on Climate Change (adopted 9 May 1992, entered into force 21 March 1994) 1771 UNTS 107 (UNFCCC), Art 2.
[38] *The South China Sea Arbitration (The Republic of Philippines v The People's Republic of China)* (Award) (12 July 2016) PCA Case No 2013-19, para 941. That this provision imposes a duty upon states is well established, see note 1093 and the references cited therein.
[39] ibid para 941. See also Agenda 21, para 17.22: "States…commit themselves…to prevent, reduce and control degradation of the marine environment so as to maintain and improve its life-support and productive capacities."
[40] ibid.
[41] LOSC, Art 194(5).

and all seas and adjacent coastal areas,'[42] and the OSPAR Convention identifies the compartments of the marine environment as 'water, sediments and biota.'[43]

The tribunal in the *South China Sea Arbitration* stated that the conservation of marine living resources is also 'an element in the protection and preservation of the marine environment.'[44] This includes, *inter alia*, fish, animals, molluscs and corals[45] - fauna identified to be most at risk from ocean acidification and warming. Similarly, the *Chagos Marine Protected Area Arbitration* tribunal was clear that states' duty to preserve the marine environment is not restricted to pollution control.[46] The marine environment that states are required to protect and preserve thus includes biodiversity, particularly where species are threatened and ecosystems are fragile, and this interpretation extends to the obligations in Articles 192[47] and 194.

3.2 Are GHG emissions 'pollution of the marine environment'?

Article 1(1)(4) provides the following definition for 'pollution of the marine environment',

> the introduction by man [sic], directly or indirectly, of substances or energy into the marine environment, including estuaries, which results or is likely to result in such deleterious effects as harm to living resources and marine life, hazards to human health, hindrance to marine activities, including fishing and other legitimate uses of the sea, impairment of quality for use of sea water and reduction of amenities.

It is unequivocal that climate change has had, and continues to have, 'deleterious effects' on the ocean. Evidence also shows that the primary cause of these effects is the introduction of anthropogenic CO_2 emissions into the atmosphere, meaning that there is a proven correlation between increased GHG emissions and harm to marine life. CO_2 is also the main driver of ocean acidification. Article 194(3) refers to 'toxic, harmful or noxious' substances as a source of pollution of the marine environment, and in this context, GHGs are undeniably so. It is extremely likely that GHG emissions, *particularly* CO_2, satisfy the definition of pollution under the LOSC.

Article 212 specifically requires states to take measures to prevent pollution of the marine environment 'from or through' the atmosphere, and this is applicable to the airspace under states' sovereignty or via flag state jurisdiction, so includes aircraft. This is significant given that emissions from aviation are a substantial source of GHG emissions.[48] The LOSC also requires parties to adopt laws and regulations to prevent, reduce and control pollution from land-based sources in Article 207, for example, through the burning of fossil fuels for electricity, heat and transportation. Though the provision places a duty upon states to prevent pollution from sources 'including rivers, estuaries, pipelines and outfall structures', the use of the word 'including' preceding this list clearly does not preclude the applicability of Article 207 to other land-based sources. For example, the tribunal in the *Iron Rhine Arbitration* noted

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[42] Agenda 21, para 17.1.
[43] Convention for the Protection of the Marine Environment of the North-East Atlantic (adopted 22 September 1992, entered into force 25 March 1998) 2354 UNTS 67 (OSPAR Convention), Annex IV, Art 1.
[44] *South China Sea Arbitration* (n 38), para 956, citing *Southern Bluefin Tuna Cases (New Zealand v Japan; Australia v Japan)* (Provisional Measures) (1999) 38 ILM 1624 (Order of 27 August 1999) para 70.
[45] ibid.
[46] *Chagos Marine Protected Area (Mauritius v United Kingdom)* (Award) (18 March 2015) PCA Case No 2011-13, paras 320, 538.
[47] *South China Sea Arbitration* (n 38), paras 945, 959.
[48] See DS Lee et al., 'The contribution of global aviation to anthropogenic climate forcing for 2000 to 2018' (2021) 244 Atmospheric Environment 117834.

that it is a principle of general international law 'to prevent, or at least mitigate' significant harm to the environment when pursuing development activities.[49] This duty has been confirmed to be within the scope of the general obligation in Article 192, despite not being expressly included as a land-based pollution source in the Article 207 list.[50]

The duty to prevent, reduce and control pollution is also applicable to vessel-source GHG emissions by virtue of Article 211. Although land-based sources are considered to be the main source of GHG emissions, ships also account for a significant amount – approximately 1 billion tonnes between 2007-2012[51] – and evidence shows that emissions from the shipping and fishing industries are increasing.[52] Many ships also burn fossil fuels that create black carbon emissions, which is the second largest contributor to the climate impact of shipping after CO_2.[53] Ship-emitted black carbon in the Arctic is particularly problematic. When particles land on snow or ice, black carbon's warming impact is seven to ten times greater,[54] reducing reflectivity and absorbing more heat, which accelerates the melting of the cryosphere. Though Article 211 is unlikely to go further than covering emissions from ships or aircraft,[55] it remains a key provision to mitigate climate impacts from vessel-source GHGs.

3.3 What is the extent of the obligation to mitigate in the LOSC?

The LOSC places a duty upon states to prevent, reduce and control GHG emissions from vessel and land sources insofar as they have deleterious effects on the marine environment, which includes marine biota. Effectively it is a duty of due diligence, focussing on conduct rather than result.[56] Due diligence can be complex, but at its core it is 'concerned with supplying a standard of care against which fault can be assessed.'[57] However, the lack of specificity in the obligations may make it difficult to conclusively determine the level of conduct required of states. The obligation to 'prevent, reduce and control' does not strictly require the cessation of emissions, though it could also be argued that 'prevent' means 'to stop something from happening'[58] where it has a deleterious effect on the marine environment. States shall also use 'the best practicable means at their disposal and in accordance with their capabilities',[59] which indicates there may be some flexibility in how they satisfy the obligation.[60] Additionally, this raises the concern of flags of convenience, where ships are

[49] *Arbitration Regarding the Iron Rhine ("Ijzeren Rijn") Railway (the Kingdom of Belgium and the Kingdom of the Netherlands*) (Award) (24 May 2005) PCA Case No 2003-02, para 59.
[50] *The South China Sea Arbitration* (n 38), para 941.
[51] Naya Olmer et al., *The International Council on Clean Transportation Report: Greenhouse Gas Emissions from Global Shipping, 2013-2015* (October 2017) iii, available at <https://theicct.org/wp-content/uploads/2021/06/Global-shipping-GHG-emissions-2013-2015_ICCT-Report_17102017_vF.pdf>.
[52] ibid iv; Enric Sala et al., 'Protecting the global ocean for biodiversity, food and climate' (2021) 592 Nature 397.
[53] ibid v.
[54] Sian Pryor, 'How the shipping industry can halve climate-warming black carbon in the Arctic' (*Climate Home News*, 18 March 2021), available at <https://www.climatechangenews.com/2021/03/18/shipping-industry-can-halve-climate-warming-black-carbon-arctic/>.
[55] Alan Boyle, 'Protecting the Marine Environment from Climate Change: the LOSC Part XII Regime' in Elise Johansen, Signe Veierud Busch, and Ingvild Ulrikke Jakobsen (eds), *The Law of the Sea and Climate Change: Solutions and Constraints* (Cambridge University Press 2020) 87.
[56] See for example, *Pulp Mills on the River Uruguay (Argentina v Uruguay) (Judgment)* [2010] ICJ Rep 14, para 197, referring to the 1975 Statute of the River Uruguay.
[57] International Law Association, Study Group on Due Diligence in International Law, Second Report (July 2016) 2, available at <https://www.ila-hq.org/index.php/study-groups?study-groupsID=63>.
[58] 'Prevent', Cambridge Dictionary, available at <https://dictionary.cambridge.org/dictionary/english/prevent>. However, interpreting 'prevent' as requiring cessation arguably may render 'reduce and control' superfluous.
[59] LOSC, Art 194(1).
[60] Though provisions relating to responsibility and liability may apply equally to developing and developed states, *Responsibilities and Obligations of States Sponsoring Persons and Entities with Respect to Activities in the Area* (Advisory Opinion) (2011) ITLOS Case No 17 (1 February 2011) paras 158-9.

registered in states that have less robust regulatory rules and less capacity, means or political will to implement and enforce environmental standards. While coastal states have power to enforce standards in national waters, it could be more challenging to hold such ships to account in the high seas due to flag state jurisdiction.[61] Thus, in respect of the duty to reduce GHG emissions, the LOSC does not go beyond the general principles of international law that require due diligence and a precautionary approach.

However, the LOSC was never anticipated to be a standalone instrument and other regimes that establish international rules may be incorporated.[62] This means that general obligations under the convention may be turned into specific obligations of performance through the introduction of clear standards. The LOSC is not a framework treaty in the way that many international environmental treaties are, such as the UN Framework Convention on Climate Change (UNFCCC). Such conventions are characterised by the formal creation of institutional structures that enable a process of incremental law-making.[63] However, the LOSC does reference rules of general international law[64] and incorporates internationally accepted rules and standards that can be found in other treaties.[65] For example, the International Convention for the Prevention of Pollution from Ships (MARPOL) establishes standards for shipping pollution that are also incorporated under the LOSC.[66] The *South China Sea Arbitration* tribunal also held that the LOSC incorporated the 1972 Convention on the International Regulations for Preventing Collisions at Sea (COLREGs)[67] and so a violation of the COLREGS constitutes a violation of the LOSC itself.[68]

States also have a duty under the LOSC to cooperate on a global basis to formulate international rules and standards for the protection of the marine environment[69] and the obligations relating to the protection of the marine environment are without prejudice to specific obligations in other conventions. In respect of GHG emissions, the UNFCCC, the 1997 Kyoto Protocol[70] and the 2015 Paris Agreement[71] ('the UNFCCC system') would most likely be viewed as the internationally accepted standards, given their near-universal membership.

3.3.1 The UNFCCC system and standard setting

The UNFCCC does not define mitigation, but Article 2 provides a clear mitigation goal: to stabilize 'greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system.'[72] The provision also requires that this stabilisation 'should be achieved within a timeframe 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.' As a framework convention, the

[61] See generally, Richard Barnes, 'Flag States' in in Rothwell, Oude Elferink, Scott and Stephens (n 6) 304-24.
[62] LOSC, Art 237.
[63] T Smith, 'A Framework Convention for the Protection of the Environment in Times of Armed Conflict' (2020) 11 Journal of International Humanitarian Legal Studies 148, 149.
[64] For example, LOSC Preamble, Art 2, Art 58, and Art 221.
[65] For example, Art 60, Art 197, and Art 222.
[66] 1973/78 International Convention for the Prevention of Pollution from Ships (adopted 17 February 1978, entered into force 2 October 1983) 1340 UNTS 184 (MARPOL).
[67] 1972 Convention on the International Regulations for Preventing Collisions at Sea, adopted 20 October 1972, entry into force 15 July 1977, 1050 UNTS 16 (COLREGs).
[68] *South China Sea Arbitration* (n 38), para 1083.
[69] LOSC, Art 197. See also, *The MOX Plant Case (Ireland v United Kingdom)* (Provisional Measures) (2001) 41 ILM 405 (Order of 3 December 2001) para 82.
[70] Kyoto Protocol to the United Nations Framework Convention on Climate Change, (adopted 11 December 1997, entered into force 16 December 2005) 2303 UNTS 162 (Kyoto Protocol).
[71] Paris Agreement, 12 December 2015, Annex of Decision 1/CP.21, 'Adoption of the Paris Agreement' (adopted 12 December 2015, entered into force 4 November 2016).
[72] UNFCCC, Art 2.

UNFCCC provides the platform for several other international agreements to progress towards mitigation, including the Kyoto Protocol and the Paris Agreement.

The Kyoto Protocol set binding emission reduction targets applicable to specific developed states between 2008-12, equalling a reduction of five percent in GHG emissions relative to 1990 levels.[73] The 2012 Doha Amendment to the Kyoto Protocol introduced a second commitment period between 2013-20 for parties that agreed to it, collectively seeking to cut emissions by at least 18 percent below 1990 levels.[74] Although they do set emissions targets, events have now surpassed these targets and they are no longer sufficient to mitigate the effects of climate change. Given this, it is very unlikely that meeting the targets set out in the Kyoto Protocol would fulfil the LOSC obligation to protect and preserve the marine environment, particularly as only certain states have reduction commitments.[75]

The Paris Agreement provided a temperature goal for the UNFCCC system for first time, aiming to limit global warming to well below 2°C and pursuing efforts to limit the temperature increase to 1.5°C, relative to pre-industrial levels.[76] These temperature targets are not explicitly linked to the ocean and there is no pH target despite acidification concerns. In fact, 'ocean' is mentioned just once in the Paris Agreement, in its preamble. To achieve the temperature goal, parties must reach global peaking of GHG emissions as soon as possible and thereafter, undertake rapid reductions.[77] The 'aim' is to achieve a balance between anthropogenic emissions by sources and removals by sinks of GHGs in the second half of this century.[78] In doing so, parties unilaterally declare actions they will take to reduce GHGs in plans known as nationally determined contributions (NDCs), in addition to identifying actions to adapt and build resilience to a changing climate.

On one hand the inclusion of a temperature goal gives some precision, but on the other hand, many of its provisions still lack sufficient specificity and obligation to have a comprehensive normative effect. 'As soon as possible' is a vague measurement of time and 'the second half of this century' could be any point until 2099. Additionally, the requirement to 'pursue efforts' to limit the temperature increase and to 'aim' to reach global peaking suggests that states do not actually have to achieve the goals and they may be aspirational non-obligations.[79] Still, even if states do not substantively meet the temperature target, it remains an obligation of conduct. Generally, obligations relating to conduct are more common than obligations of result in international law, giving states autonomy and flexibility in discharging international obligations.[80] These are not negative obligations and there is clearly a requirement to do *something*.

3.3.2 Is adherence to the Paris Agreement enough to fulfil LOSC obligations?

The requirement in the LOSC to ensure states' national laws give effect to internationally agreed rules and standards is relatively weak. Article 207(1) requires states to adopt laws and regulations to prevent, reduce and control pollution of the marine environment from land-based sources, 'taking into account' international rules. The same applies to pollution from or through

[73] Kyoto Protocol, Annex B.
[74] Doha Amendment to the Kyoto Protocol, 8 December 2012, Annex of Decision 1/CMP.8, 'Amendment to the Kyoto Protocol pursuant to its Article 3, paragraph 9 (Doha Amendment)' (adopted 8 December 2012, entered into force 31 December 2020) 2303 UNTS 162.
[75] For example, China and India are the first and third biggest GHG emitters respectively and they did not have commitments under the Protocol.
[76] Paris Agreement, Art 2.
[77] Paris Agreement, Art 4.
[78] ibid.
[79] Lavanya Rajamani, 'The 2015 Paris Agreement: interplay between hard, soft and non-obligations' (2016) 28 Journal of Environmental Law 337, 345; Article 4(1) is identified as a non-obligation, for example.
[80] ILA, Due Diligence Report (n 57) 2.

the atmosphere.[81] However, Article 213 bolsters this by requiring states to 'adopt laws and regulations and take other measures necessary to implement applicable international rules and standards established through competent international organizations.'[82] This is further strengthened by Article 207(5**),** which provides that states shall adopt laws and regulations that 'minimize, to the fullest extent possible, the release of toxic, harmful or noxious substances, especially those which are persistent, into the marine environment.' In any case, given that the Paris Agreement now has near universal participation,[83] most states will already have a duty to undertake 'ambitious efforts' in respect of their NDCs under that agreement.[84] A more contentious theory is that even non-parties to the Paris Agreement may have a duty to consider it when adopting national laws, if the agreement is viewed as establishing internationally agreed rules and standards, due to the wording of Article 207 requiring states to take them into account.[85] Though it is debatable whether international courts and tribunals would interpret the provision so strictly in practice given that it encroaches upon state consent.

However, the real question is whether adhering to the standards in the UNFCCC system can fulfil LOSC obligations to protect and preserve the marine environment to the extent required. Problems with the Paris Agreement, such as specificity and soft/non-binding obligations are identified above. Moreover, there is no target for addressing the mitigation of CO_2 specifically, despite the challenge of ocean acidification,[86] no temperature or pH target linked to the ocean and no requirement for NDCs to be tailored to the ocean. The UNFCCC system also sustains the balance between the protection of the marine environment and sustainable economic development, providing states with a margin of appreciation in which to fulfil their obligations. The effectiveness of the obligations in the LOSC is thus constrained by the Paris Agreement.

Boyle states that courts are unlikely to require that states go over and above what is required by the Paris Agreement, so adherence to the standards therein is likely to satisfy the due diligence obligation.[87] Scott notes the irony of the LOSC's 'framework' arrangement, which enables it to incorporate relevant international standards to bolster provisions, but actually operating as an 'impediment or constraint' for ocean acidification because of those standards.[88] If solely considering the LOSC, the obligation to mitigate GHG emissions may actually be stronger than the Paris Agreement despite its generality, if interpreted by reference to due diligence and the precautionary approach.[89]

4. **Climate Adaptation and the LOSC**

It is clear by now that mitigation efforts on their own are no longer sufficient to protect biodiversity as the climate changes; species also require support to adapt to a changing environment. Climate adaptation is defined by the IPCC as 'the adjustment of natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates

[81] LOSC, Art 212(1).
[82] Art 214 and 222 have similar provisions.
[83] Of the UNFCCC member states, Eritrea, Iran, Libya and Yemen have signed, but not ratified, the Paris Agreement. All have ratified the Kyoto Protocol, though none are named in Annex B.
[84] Paris Agreement, Art 3.
[85] cf. Boyle (n 55) 90-91.
[86] The Glasgow Climate Pact recently set a CO_2 target for the first time, however it is not legally binding; Glasgow Climate Change Conference, Conference of the Paris 26th Session, Decision -/CMA.3 (13 November 2021), available at <https://unfccc.int/sites/default/files/resource/cop26_auv_2f_cover_decision.pdf>.
[87] Boyle (n 55) 94.
[88] K Scott, 'Ocean Acidification' in Johansen, Busch and Jakobsen (n 55) 126.
[89] Boyle (n 55) 93.

harm or exploits beneficial opportunities.'[90] Adaptation laws, policies and actions are largely localised to address the downscaled impacts of global climate threats so the effectiveness of international law is relatively limited in that capacity,[91] though developments in international law have provided a stronger normative and institutional framework for national laws.[92] In respect of the LOSC, the effects of climate change and GHG emissions can have considerable legal implications. Rising sea levels impact states' entitlements to maritime territory, which also affects the protection of natural resources within that territory, while acidification and ocean warming places marine ecosystems at serious risk.

4.1 Adapting to sea-level rise

The LOSC sets out several maritime zones, which are measured from a starting point known as a baseline. A state's territorial sea can extend up to 12 nautical miles (nm) from the baseline,[93] the contiguous zone to 24nm[94] and the exclusive economic zone (EEZ) to 200nm.[95] A state may also claim a continental shelf up to 200nm from the baseline, extended to 350nm provided the necessary conditions are satisfied.[96] Coastal states enjoy broad rights within these zones, perhaps most notably, sovereign rights over natural resources in their EEZs.[97] All residual maritime territory, after coastal state claims are made, comprises the high seas or the deep seabed,[98] where other states have extensive freedoms of, *inter alia*, fishing and scientific research.[99] This makes baselines important as they effectively determine the areas in which coastal states may exercise and enforce their rights, and where other states may exercise their freedoms.

The 'normal baseline' is the low-water line along the coast as marked on large-scale charts officially recognized by the coastal state,[100] though there is no definition given of 'low-water line'. Where atolls or islands with reefs are concerned, the baseline is the seaward low-water line of the reef, again shown on state charts.[101] The LOSC also provides for exceptions where normal baselines may be unsuitable. 'Straight baselines' may be drawn by joining appropriate points where the coastline is deeply indented or if there is a fringe of islands along the coast in the immediate vicinity.[102] A similar approach can be employed for archipelagic baselines,[103] deltaic baselines,[104] and baselines across the mouths of rivers and bays.[105]

These rules establishing maritime territory reflect the 'package-deal' approach to the LOSC negotiations and adhere to the principle that baselines should follow the general direction of the coast.[106] Most commentators consider that this attachment to the coastline

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[90] IPCC, *Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change (AR4)* (Cambridge University Press 2007) 750.
[91] Robin Kundis Craig, 'Mitigation and Adaptation' in Johansen, Busch and Jakobsen (n 55) 56.
[92] Jan McDonald and Phillipa C McCormack, 'Rethinking the role of law in adapting to climate change' (2021) 12 WIRES Climate Change e726.
[93] LOSC, Art 3.
[94] LOSC, Art 33.
[95] LOSC, Art 57.
[96] LOSC, Art 76.
[97] LOSC, Art 56.
[98] LOSC, Art 86, Art 1(1)(1).
[99] LOSC, Arts 87, 89.
[100] LOSC, Art 5.
[101] LOSC, Art 6.
[102] LOSC, Art 7(2).
[103] LOSC, Art 47. Other conditions must also be met.
[104] LOSC, Art 7(2).
[105] LOSC, Arts 11,12.
[106] *Fisheries (United Kingdom v Norway)* [1951] ICJ Rep 116, 133.

effectively makes baselines movable or 'ambulatory.'[107] So if the shoreline moves landward, so does the baseline, and if the baseline retreats, so do the outer limits of the maritime zones. This theory severely affects states' entitlement to their maritime territory and associated natural marine resources.

Low-lying island states, the countries least responsible for global warming, could be disproportionately impacted and at risk of losing their maritime territory altogether. States such as the Maldives, where the highest point of land is just two metres above sea level, could be submerged entirely. The reduction of maritime territory enables other states to move into what would effectively become the high seas and take resources that otherwise would have belonged to the affected state: states would be able to take advantage of others' losses. In some cases, protected marine ecosystems could be exposed to new forms of resource extraction, disturbance and loss. Many of the low-lying Pacific islands also have large marine protected areas (MPAs) in their territorial waters and this appears to put them at potential risk. For the LOSC, this is a live issue;[108] a 'legal feedback'.[109] While climate-induced sea-level rise may deprive states of their land territory, it is international law that can deprive them of their seas[110] and put marine biodiversity at greater risk.

4.1.1 Maritime zones around artificial islands and reclaimed land

In the face of inevitable sea-level rise, some states at risk of submersion have begun pursuing land reclamation activities to build artificial territory and islands to relocate their citizens displaced by climate change. Hulhumalé in the Maldives, built from sand pumped from the seabed, is now home to over 50,000 people.[111] Although this could be an option to regain land territory, the LOSC may provide an obstacle to retaining maritime territory. Article 121 LOSC defines an island as a 'naturally formed area of land' which is above water at high tide and is inhabitable; these can generate maritime zones. As artificial islands are not 'naturally formed', they cannot generate maritime territory.[112] A related issue exists when distinguishing islands from rocks, which 'cannot sustain human habitation or economic life of their own.'[113] These cannot generate EEZs or continental shelves. This means that as islands become uninhabitable, for example, through coastal erosion or lack of drinking water due to saltwater encroachment into freshwater aquifers, the state could lose its EEZ in accordance with LOSC provisions.

However, although the tribunal in the *South China Sea Arbitration* rejected the idea that rocks could be artificially transformed into islands,[114] where pre-existing islands are

[107] See for example, David Caron, 'Climate Change, Sea-level rise and the Coming Uncertainty in Oceanic Boundaries: A Proposal to Avoid Conflict' in Seoung-Yong Hong and Jon M Van Dyke (eds), *Maritime Boundary Disputes, Settlement Processes, and the Law of the Sea* (Martinus Nijhoff 2009) 9.

[108] See for example, Alfred HA Soons, 'The Effects of a Rising Sea Level on Maritime Limits and Boundaries' (1990) 37 Netherlands International Law Review 207; Kya Raina Lal, 'Legal Measures to Address the Impacts of Climate Change-induced Sea Level Rise on Pacific Statehood, Sovereignty and Exclusive Economic Zones' (2017) 23 Auckland University Law Review 235; Coalter G Lathrop, J Ashley Roach and Donald R Rothwell (eds), *Baselines under the International Law of the Sea: Reports of the International Law Association Committee on Baselines under the International Law of the Sea* (Brill 2019), available at <https://www.ila-hq.org/images/ILA/DraftReports/DraftReport_Baselines.pdf>. The International Law Commission also adopted sea-level rise as part of its long-term work programme in 2019.

[109] Caron (n 107) 2.

[110] Lilian Yamamoto and Miguel Esteban, *Atoll Island States and International Law: Climate Change Displacement and Sovereignty* (Springer 2014) 140.

[111] Norman Miller, 'A new island of hope rising from the Indian Ocean', (*BBC News*, 11 September 2020), available at <https://www.bbc.com/travel/article/20200909-a-new-island-of-hope-rising-from-the-indian-ocean>.

[112] LOSC, Art 60(5).

[113] LOSC, Art 121(3).

[114] *South China Sea Arbitration* (n 38), paras 509, 510.

bolstered their status should be ascertained on the basis of their 'earlier, natural condition, prior to the onset of significant human modification.'[115] This means that where a feature is 'naturally' an island, any modification or installation would not cause it to become artificial.[116] It is unclear whether this would also apply to islands that have already become rocks and so whether modification of at-risk islands should occur sooner rather than later.

Even so, while this kind of land reclamation could enable states to retain both land and maritime territory, it is a Pyrrhic victory given evidence that it can exacerbate climate impacts and destroy coral reefs.[117] For example, experts in the *South China Sea Arbitration* stated that the construction activities had 'impacted reefs on a scale unprecedented in the region', destroying up to 60 percent of the shallow reef habitat of affected reefs.[118] For states such as the Maldives, where coral reefs are the dominant ecosystems,[119] this could be disastrous. Land reclamation generally leads to a decline in biological diversity and habitats, meaning that states may well breach obligations under Article 192 and 194 LOSC in conducting such activities.[120]

4.1.2 Maintaining the outer limits of maritime zones and baselines

To prevent the loss of maritime territory without deleterious effects on marine biodiversity, one course of action may be to fix the outer limits of maritime zones. The LOSC explicitly provides for this in just one circumstance. Article 76 refers to both 'fixed points', defined by coordinates of latitude and longitude, comprising the line of the outer limits of the continental shelf beyond 200nm, and the requirement to deposit the information 'permanently describing' these limits with the UN Secretary-General under paragraph nine. One theory is that paragraph nine relates to the extended continental shelf only, meaning only the outer limit of an extended shelf is permanently fixed.[121] However, paragraph nine does not make a distinction between the limits of the whole continental shelf and the limits of the shelf beyond 200nm. Neither does this obligation to deposit information explicitly follow on from paragraph eight which does make that distinction. It is a related, but separate, provision. States need not submit information to exercise their entitlement to their continental shelf within the 200nm limit, however unilateral submission could enable them to 'permanently describe' its outer limits.

For other maritime territory, where there is no explicit right to permanently freeze outer limits (but no denial of such a right, either), the limitations on the breadths of maritime zones which are measured from the baseline could become a challenge. Fixing the outer limits of zones where baselines move landwards could cause a state's zones to become greater than what the LOSC permits. This could create disputes if other states contend that LOSC provisions have been breached, in addition to situations where unforeseen ecological changes could justify the revocation of treaties establishing EEZ boundaries in exceptional cases.[122]

Another course of action to preserve states' maritime territory would be to freeze baselines. An exception to the ambulatory baselines theory exists where 'a delta and other

[115] *ibid*, paras 305-6.
[116] See Reece Lewis, 'The Artificial Construction and Modification of Maritime Features: Piling Pelion on Ossa' 52(3) Ocean Development and International Law 239, 249-51.
[117] Huabo Duan et al., 'Characterization and environmental impact analysis of sea land reclamation activities in China' (2016) 130 Ocean & Coastal Management 128.
[118] Sebastian CA Ferse, Peter Mumby and Selina Ward, 'Assessment of the potential environmental consequences of construction activities on seven reefs in the Spratly Islands in the South China Sea', Expert Report for the South China Sea Arbitration (n 40) 3, available at <https://pcacases.com/web/sendAttach/1809>.
[119] Maldives Country Profile, Convention on Biological Diversity, available at <https://www.cbd.int/countries/profile/?country=mv>.
[120] *South China Sea Arbitration* (n 38), para 983.
[121] For example, see Stephens (n 6) 789.
[122] See Snjólaug Árnadóttir, 'Ecological changes justifying termination or revision of EEZ and EFZ boundaries' (2017) 84 Marine Policy 287. See also generally, Snjólaug Árnadóttir, *Climate Change and Maritime Boundaries: Legal Consequences of Sea Level Rise* (Cambridge University Press 2021).

natural conditions'[123] make the coastline 'highly unstable', in which case straight baselines may be fixed in place and remain 'effective until changed by the coastal state.'[124] This provision is to be read independently from Article 7(1),[125] so it is not necessary to also fulfil the criteria of having a deeply indented coastline. States may unilaterally choose their own approach to determine baselines,[126] including a combination of methods, and there is also no rule stating that once baselines are drawn, they cannot be re-drawn by the state. Where there is climate-induced sea-level rise, 'natural conditions' that cause the coastline to be 'highly unstable' are arguably present. The most at-risk states currently have archipelagic baselines,[127] but adopting this interpretation may enable some to re-draw straight baselines where the coast is unstable, permanently fixing them under Article 7(2), provided they continue to meet the archipelagic criteria.

Article 7(3) could be problematic for a receding or coastline, given that baselines must 'not depart to any appreciable extent from the general direction of the coast.' However, the International Law Association (ILA) Committee on Baselines considered that the 'general direction' criterion is 'devoid of any mathematical precision', as recognised in the *Fisheries Case*, giving states a margin of appreciation in drawing straight baselines under paragraph two.[128] Another issue may be the lack of state practice on the application of Article 7(2) as maritime boundaries and delimitation can be very contentious in practice: 90 states have adopted straight baselines and there have been 56 individual protests by other states.[129] Utilising approaches that are perceived to have little legitimacy may encourage such disputes. That being said, state practice on Article 7 in general has been extremely varied so there is not a single agreed approach,[130] and the scale and extent of sea-level rise over coming years will be sufficiently disruptive that even a consistent and agreed approach may well have been challenged.

The ambulatory baseline theory is largely based on the negative implication that, because there is explicit reference to a fixed baseline in only one situation, all others must be ambulatory.[131] However, the original proposal for Article 7(2) was put forward by Bangladesh to address the lack of a stable low-water line upon which to base the baseline due to the Ganges-Brahmaputra delta.[132] The LOSC drafters considered that coastline changes would otherwise be rare and isolated,[133] so explicit provision was made for the adoption of fixed straight baselines where the coastline is 'highly unstable' due to natural conditions. The drafters of the LOSC could not have intended for the provisions on baselines to be interpreted in such a way that destabilizes global maritime territory and deprives states of their entitlement to it. A better approach builds on Purcell's argument that baselines are not ambulatory, given the priority

[123] For a comprehensive analysis of Art 7(2), see Signe Veierud Busch, 'Sea Level Rise and Shifting Maritime Limits: Stable Baselines as a Response to Unstable Coastlines' (2018) 9 Arctic Review 174, 182-4.
[124] LOSC, Art 7(2).
[125] ILA, Baselines Report (n 108) para 106.
[126] LOSC, Art 14; ILA, Baselines Report (n 108) para 64.
[127] ibid, Appendix 3. For example, the Bahamas, Fiji, Kiribati, the Maldives, the Marshall Islands, Tuvalu and Vanuatu.
[128] ILA, Baselines Report (n 108) para 106.
[129] ILA, Baselines Report (n 108), Appendix 2 (updated 1 June 2018).
[130] Busch (n 123) 188.
[131] Caron (n 107) 9; David Caron, 'When Law Makes Climate Change Worse: Rethinking the Law of Baselines in Light of a Rising Sea Level' (1990) 17(4) Ecology Law Quarterly 621; Soons (n 108) 216; Snjólaug Árnadóttir, 'Fluctuating boundaries in a changing marine environment' (2021) 34 Leiden Journal of International Law 471, 471-2; ILA Baselines Report (n 108) para 31.
[132] 'Bangladesh Position on the Question of Baseline', Caracas Session 1974, reproduced in R Platzöder, *Third United Nations Conference on the Law of the Sea: Documents, Vol IV* (Oceana Publications 1983) 179.
[133] Caron (n 107) 5.

afforded to state control over their maritime territory under the law of the sea.[134] Taking this approach, states could retain their existing baselines under existing LOSC provisions, though, again, this could still give rise to disputes if states decide there is no explicit support for it in the LOSC. Giving states the option to retain their maritime territory could also discourage economic wastage. For example, it is estimated that Japan has spent an estimated $600 million to fortify Okinotorishima, a tiny atoll, to prevent erosion,[135] the continued existence of which enables it to significantly extend its EEZ.

4.1.3 Protecting biodiversity

The discourse on sea-level rise and the law has largely been limited to boundaries, territory, statehood and population.[136] However, sea-level rise will also significantly impact biodiversity, particularly species that inhabit intertidal and coastal areas. Species in terrestrial, low-lying habitats are also at serious risk, which can impact the ecosystem as a whole. In the USA alone, 233 protected species are currently threatened by rising sea levels, including the endangered Key deer, of which there are just 800.[137] The Bramble Cay melomys, a small rodent that lived on a low-lying reef in the Great Barrier Reef, was classified as extinct in 2016 due to sea-level rise and saltwater inundation.[138]

In the coastal marine environment, 'vermetid' reefs and the biodiversity they support are also threatened by sea-level rise. These little-known bioconstructions are built by gastropods and coralline alga in the intertidal zone and are usually visible at low tide. Not only do they provide a habitat for marine species, but they are also a significant indicator of past and current climate impacts[139] and act as a natural buffer to protect the coast from erosion. Biodiversity is greatly reduced when these reefs become permanently submerged, particularly if they are also exposed to grazing by invasive fish, encouraged to these areas by warming waters.[140] Similarly, mangrove forests have considerable value as a natural buffer against storm surges and erosion yet are unlikely to survive if sea-level rise surpasses 7mm per year, particularly when that sea-level rise is combined with other climatic impacts such as heatwaves,

[134] Kate Purcell, 'Maritime Jurisdiction in a Changing Climate' in Michael B Gerrard and Katrina Fischer Kuh (eds), *The Law of Adaptation to Climate Change: United States and International Perspectives* (ABA 2012) 739, and for a summary of this analysis, Stephens (n 6) 789. See also Kate Purcell, *Geographical Change and the Law of the Sea* (OUP 2019).

[135] Ralph Jennings, 'Japan Is Quietly Building a Tiny Tropical Islet, But an Angry China Has Noticed', Forbes (*Forbes*, 17 July 2016), available at <https://www.forbes.com/sites/ralphjennings/2016/07/17/japan-is-quietly-building-a-tiny-tropical-islet-but-an-angry-china-has-noticed/>.

[136] British Institute of International and Comparative Law, 'Rising Sea Levels: The role of the International Law Commission' Report (3 March 2021) <https://www.biicl.org/documents/10719_rising_sea_levels_episode1_report.pdf>.

[137] Centre for Biological Diversity, *Deadly Waters: How Rising Seas Threaten 233 Endangered Species* (December 2013), available at <https://www.biologicaldiversity.org/campaigns/sea-level_rise/pdfs/Sea_Level_Rise_Report_2013_web.pdf> 4.

[138] Michael Slezak, 'Revealed: first mammal species wiped out by human-induced climate change' (*The Guardian*, 14 June 2016) available at < https://www.theguardian.com/environment/2016/jun/14/first-case-emerges-of-mammal-species-wiped-out-by-human-induced-climate-change>.

[139] G Sisma-Ventura et al., 'Assessing vermetid reefs as indicators of past sea levels in the Mediterranean' (2020) 429 Marine Geology 106313; Renato Chemello and Sergio Silenzi, 'Vermetid reefs in the Mediterranean Sea as archives of sea-level and surface temperature changes' (2011) 27(2) Chemistry and Ecology 121.

[140] Gil Rilov et al., 'Sea-level rise can severely reduce biodiversity and community net production on rocky shores' (2021) 791 Science of the Total Environment 148377.

storm surges and more frequent and intense cyclones.[141] Under high emissions scenarios, this threshold will be met in some regions as soon as 2050.[142]

It is unlikely that the LOSC could be utilised to extend direct protections to terrestrial species such as the Key deer, given that they do not fall within the definition of a marine environment. However, where marine species are concerned, although the Convention does not explicitly provide for the creation of MPAs, states have considerable jurisdiction in internal and territorial waters to create MPAs, and this mechanism may help to extend protection to species associated with intertidal and marine systems, such as the Key deer.[143] Thousands of marine protected areas comprising 17.86 percent of national waters have already been created by states globally.[144] Protecting biodiversity such as mangrove forests, reefs and seagrass in these areas will not only provide direct protection to marine flora and fauna, but will also help sustain natural buffers to sea-level rise and extend protections to land-dwelling species. For example, in the United States, if existing coastal habitats remain fully intact, many national impacts of sea-level rise could be reduced by half.[145]

4.2 Adapting to a changing marine environment

The creation of MPAs could also facilitate the protection of species that are shifting their distribution or otherwise trying to adapt to rapidly changing marine conditions stemming from climate change and ocean acidification. As noted above, the LOSC gives states considerable power in their internal waters and territorial sea to create MPAs given their sovereignty in these zones. States also have sovereign rights to explore and exploit natural resources in their EEZ and continental shelf, giving them the ability to take measures to prevent the over-exploitation of living resources,[146] including setting a total allowable catch, closing areas and seasons, and implementing limitations on gear, by-catch and minimum fish size.[147] Fisheries dominate these provisions and the focus is also very much on stocks as a resource to be utilised. While the provisions could theoretically be used as a basis for action to minimise the impacts of climate change and ocean acidification on such species, it seems unlikely in practice.

States also have jurisdiction over pollution in these areas and are obliged to take measures to protect and preserve the marine environment, as examined above in part three of this Chapter. The LOSC's incorporation of international shipping standards such as MARPOL enables states to cooperate directly or through the International Maritime Organization (IMO) to take measures against vessel source pollution,[148] such as the designation of a Particularly Sensitive Sea Area where an ecologically significant area needs special protection. This would need to be balanced with states' freedom of navigation in the EEZ,[149] though ships routeing measures can be implemented in Potentially Sensitive Sea Areas where necessary and if endorsed by the IMO.[150]

However, the LOSC's zonal approach complicates matters in areas beyond national jurisdiction (ABNJ), particularly given that the water column and seabed have distinct legal

[141] N Saintilan et al., 'Thresholds of mangrove survival under rapid sea-level rise' (2020) 368(6495) Science 1118; S Abhik et al, 'Influence of the 2015-2016 El Niño on the record-breaking mangrove dieback along northern Australia coast' (2021) 11 Scientific Reports 20411.
[142] IPCC, *SROCCC Technical Summary* (n 11) 20.
[143] LOSC, Art 2(1).
[144] Available at <https://www.protectedplanet.net/en/thematic-areas/marine-protected-areas#distribution>.
[145] Katie K Arkema et al., 'Coastal habitats shield people and property from sea-level rise and storms' (2013) 3 Nature Climate Change 913.
[146] LOSC, Art 61.
[147] LOSC, Art 62(4).
[148] LOSC, Arts 197, 200, 237(1).
[149] LOSC, Art 58(1).
[150] For example, in the Great Barrier Reef, Torres Strait and Coral Sea.

regimes.[151] Despite the recognition of the oceans in the LOSC's preamble as an 'integrated whole', the treaty cannot be described as having an integrated approach.[152] It has also been more difficult to protect living resources in ABNJ under the LOSC regime given that there is no explicit mandate to create MPAs in ABNJ – just 1.18 percent are designated as protected areas.[153] Jurisdiction over the high seas is heavily restricted,[154] so the ability of states to take unilateral measures to protect marine biodiversity is extremely limited, though they can exercise jurisdiction over their own vessels to effectively implement national mitigation standards. Still, unless a MPA is adopted by a regional or global body, states will ignore a unilateral designation.

In ABNJ, although there are agreements in place to regulate the appropriation of specific species,[155] straddling fish stocks, and highly migratory species,[156] states currently have extensive freedom to appropriate other biodiversity in these areas. This is somewhat tempered by the obligation of due regard[157] and the duty to cooperate with other states in the conservation of living resources,[158] but the obligations are relatively general and not well implemented or enforced.[159] Not only does this affect biodiversity currently in ABNJ, but thanks to the potential fluctuation of maritime zones due to international law, more marine species could eventually fall into this regulatory black hole. This further highlights inefficiencies in the LOSC's zonal approach.

However, a treaty on the conservation and sustainable use of marine biological diversity of areas beyond national jurisdiction (BBNJ treaty), developed within the framework of the LOSC, is currently under negotiation.[160] Ecosystem-based management is typically underdeveloped in ABNJ,[161] so the BBNJ treaty promises a holistic approach that will balance sustainable use and conservation. It aims to integrate four key components:[162] area-based management tools such as the creation of MPAs, environmental impact assessments (EIA), regulation of marine genetic resources and benefit sharing, and capacity building and marine technology transfer. While it is unlikely to fully address climate-related challenges for high seas biodiversity, it does offer the potential to centrally address some of these challenges as an operative process by way of integrated ocean management. Where the LOSC has largely approached biodiversity as a resource, the BBNJ looks to shift this focus to conservation and management. The treaty could bolster the provisions in the LOSC and supplement other agreements that already have ecosystem approaches, such as the UN Fish Stocks Agreement and the Convention on Biological Diversity.[163] For example, while the LOSC provides a very general obligation to carry out EIA in Article 206, the draft text of the BBNJ formalises this obligation and provides for the setting of international standards and guidance for conducting

[151] LOSC, Parts VII, XI.
[152] Karen Scott, 'Integrated Oceans Management' in Rothwell, Oude Elferink, Scott and Stephens (n 6) 48.
[153] (n 144).
[154] LOSC, Arts 87(1), 110, 111.
[155] See for example, the International Convention on for the Regulation of Whaling (adopted 2 December 1946, entry into force 10 November 1948) 161 UNTS 72.
[156] UN Fish Stocks Agreement (adopted 4 August 1995, entry into force 11 December 2011) 2167 UNTS 3.
[157] LOSC, Arts 87(2), 116.
[158] LOSC, Art 118.
[159] Richard Barnes, 'The Convention on the Law of the Sea: An Effective Framework for Domestic Fisheries Conservation?' in David Freestone, Richard Barnes and David Ong, The Law of the Sea: Progress and Prospects (Oxford University Press 2006) 240.
[160] UNGA Res 69/292 (6 July 2015) UN Doc A/RES/69/292; UNGA Res 72/249 (24 December 2017) UN Doc A/RES/72/249.
[161] Karen Scott (n 152) 482.
[162] UNGA Res 66/231 (24 December 2011) UN Doc A/RES/66/231.
[163] Convention on Biological Diversity (adopted 5 June 1992, entry into force 29 December 1993) 1760 UNTS 79.

EIA.[164] This could also be the first global treaty to explicitly address ocean acidification and climate change in an oceanic context, providing for knowledge transfer and capacity building[165] and designation of MPAs for those reasons.[166]

5. Concluding Remarks

The 'LOSC' is not a 'one stop shop'[167] in preventing the negative impacts of climate change on marine biodiversity, but it does have an important role in protecting and preserving the marine environment. It creates obligations for states to reduce GHG emissions where they have deleterious effects on the water, seabed, and marine biodiversity. Though the language of the provisions is relatively general and permissive in parts, the LOSC does support the core objectives of climate mitigation, endorsing both due diligence and the precautionary principle. The drafting of the provisions also allows the incorporation of external internationally agreed rules, which ensures that the standards therein can be updated in accordance with the latest science as needed, without having to amend the convention itself. These standards should give greater effect to the obligations in the LOSC as the 'special law' of particular application in the marine environment, that is, the *lex specialis*.

However, in this case, the obligations and standards established by the UNFCCC system seem to diminish the provisions in the LOSC. The general and often non-obligatory nature of the Paris Agreement's provisions almost undermine the due diligence approach required of states by the LOSC. GHG emissions are dealt with very generally in the Agreement, with no specific provision for CO_2 emissions and no pH targets, despite the catastrophic impact of ocean acidification. Scott argues that it is 'disingenuous' to claim that action under the Paris Agreement could fulfil a state party's due diligence obligations under the LOSC.[168]

Yet, although it could be justifiably argued that the due diligence requirement makes the LOSC a stronger forum to deal with ocean-specific climate issues, it cannot be said that it regulates the oceanic impacts of climate change in 'splendid isolation' from the Paris Agreement.[169] As the near-universally agreed treaties that address GHG emissions, it would be difficult to argue that the UNFCCC or Paris Agreement are not applicable here, even though they provide no *lex specialis* for CO_2 limits or pH levels.[170] It is unlikely that states will be required to go beyond these agreed standards. In any case, there is no real mechanism in the LOSC for substantive collective action to deal with the challenges of climate change in the same way that the UNFCCC has, for example, in its Conference of the Parties (COP). To ensure effective mitigation of the oceanic impacts of climate change and ocean acidification, legally binding standards establishing CO_2 and pH targets should be urgently developed under the UNFCCC regime, enabling the LOSC to better facilitate climate mitigation through its Part XII provisions. Beyond this, the only way to try and influence the international agenda is through references to climate change in the UN General Assembly's annual Oceans Resolution.

Though mitigation efforts will undoubtedly help limit or avoid some of the worst impacts, they are too little, too late to prevent the literal rising tide of climate change. Given

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[164] Revised draft text of an agreement 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 (18 November 2019) UN Doc A/CONF.232/2020/3, Arts 22, 23, 24. EIA has also been recognised as a requirement of general international law where there are potential adverse transboundary impacts, *Pulp Mills* (n 60) 204.
[165] ibid, Annex II(a)(iv).
[166] ibid, Article 14(e), Annex I(f).
[167] Catherine Redgwell, 'Treaty Evolution, Adaptation and Change: Is the LOSC 'Enough' to Address Climate Change Impacts on the Marine Environment?' (2019) 34 International Journal of Marine and Coastal Law 440, 455.
[168] Scott (n 88) 127.
[169] Boyle (n 55) 93.
[170] Scott (n 88) 127.

that changes to the ocean will be irreversible for centuries to millennia, robust strategies are needed to support biodiversity adaptation. However, the LOSC could complicate global efforts. The fragmented zonal approach and the lack of certainty on the retention of maritime territory has focused the issue of sea-level rise on lines in the ocean as opposed to ecosystem health. This has already driven states to steer much-needed funds away from *de facto* climate concerns to protect *de jure* boundaries, and any perceived lack of legitimacy on approaches to fixing boundaries could give good cause for future state disputes. This legal issue must be clarified to steer conversations back towards people and biodiversity.

Although amendment of the LOSC to clarify boundary issues is theoretically possible, it is exceptionally difficult in practice: the non-objection procedure in Article 313 gives states a veto-like power and amendments adopted at a negotiating conference will be subject to the conditions on entry into force (ratification by 60 state parties).[171] The adoption of a UN General Assembly resolution could be a more realistic option and the outcome of the ILC's work will be an interesting test vehicle for international opinion on this.[172] Although not binding, any consensus could provide international legitimacy for the adoption of permanent baselines and limits where sea levels are rising. Alternatively, or concurrently, a request could be submitted to ITLOS for an advisory opinion on maritime territory and sea-level rise, clarifying the approach to be taken in accordance with the LOSC. Article 2(2) of the agreement establishing the Commission of Small Island States on Climate Change and International Law gives the Commission an express power to request advisory opinions from ITLOS,[173] and Vanuatu is also actively pursuing a campaign for an advisory opinion on climate change from the ICJ.[174] Again, these are non-binding but are authoritative and generally persuasive.

In circumstances where biodiversity must adapt to changing marine conditions, the LOSC's approach seems to be permissive-leaning due diligence. States must protect the environment, but the obligations are too general to require states to take specific measures and there are no guidelines or standards to facilitate action. States can create MPAs in national waters in accordance with their sovereign rights in those areas but given the lack of express requirements to engage with area-based management tools, states would need to be proactive in establishing MPAs of their own volition. In ABNJ, the LOSC effectively creates a regulatory black hole for biodiversity protection due to these general obligations, restricted high seas jurisdiction and its zonal approach. Again, amending the LOSC is a theoretical, but not practical, option. An Implementing Agreement offers the best solution to reinforce the LOSC's provisions without upsetting the delicate compromise of the treaty.

As an Implementing Agreement, the BBNJ has all the potential to create a more robust regulatory framework in ABNJ, but whether it will deliver on that promise remains to be seen. The package-deal approach to negotiations means that progress has been slow as 'nothing is agreed until everything is agreed',[175] and given that the longstanding LOSC debate on the common heritage of mankind and the freedom of the seas has been resurrected,[176] this could be a challenge for both adoption and eventual ratification. If specialist treaties are perceived to

[171] LOSC, Art 308.
[172] Sea-level rise in relation to international law, available at <https://legal.un.org/ilc/guide/8_9.shtml>.
[173] COSIS Agreement (n 36). For further discussion on seeking a ITLOS advisory opinion, see David Freestone, Richard Barnes and Payam Akhavan, 'Agreement for the Establishment of the Commission of Small Island States on Climate Change and International Law (COSIS)' (2022) 37 International Journal of Marine and Coastal Law 166.
[174] See <https://www.blueoceanlaw.com/blog/pacific-firm-to-lead-global-legal-team-supporting-vanuatus-pursuit-of-advisory-opinion-on-climate-change-from-international-court-of-justice>.
[175] G M Danilenko, *Law-Making in the International Community* (Martinus Nijhoff 1993).
[176] See generally, Elizabeth M De Santo et al., 'Stuck in the middle with you (and not much time left): The third intergovernmental conference on biodiversity beyond national jurisdiction' (2020) 117 Marine Policy 103957.

give rights beyond what is granted by the LOSC, this can lead to state participation problems.[177] The latest negotiations (March 2022) again failed to produce an agreed text given continued disagreement on several issues and insufficient time to address them.[178] These challenges must be quickly and effectively resolved if the BBNJ is to have any real chance at success.

The law of the sea has evolved in a steady manner over the last 30 years, responding to manageable changes as developments arise. Yet climate change not only poses the challenge of escalating change, but change that is increasing, widespread and rapidly reaching a series of tipping points. The LOSC is a living treaty, and it must be responsive to these changes to successfully support the conservation of biodiversity. For some species, the narrow window of opportunity has already closed. Resource grabbing and an overly-deferential approach to the LOSC's package-deal must not hinder its capacity to be agile and ambitious when it is most needed, and so ultimately, it is political will that will determine the effectiveness of the law of the sea's response to climate change.

[177] See for example, Hayley Roberts, 'The British Ratification of the Underwater Heritage Convention: Problems and Prospects' (2018) 67(4) International & Comparative Law Quarterly 833, 854-63.

[178] Karen McVeigh, 'UN ocean treaty summit collapses as states accused of dragging out talks' (The Guardian, 21 March 2022), available at <https://www.theguardian.com/environment/2022/mar/21/un-ocean-treaty-summit-collapses-as-states-accused-of-dragging-out-talks>.