

**PART IV:
CLIMATE CHANGE, THE LAW OF THE
SEA AND SEA-LEVEL RISE**

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Abstract

As one of the most pressing issues confronting human society, climate change has brought immense challenges to almost all aspects of our lives. This is also the case with the world's oceans. In responding to its adverse impacts, the international community has faced legal, political, and scientific challenges. This also applies to the law of the sea regime represented by the United Nations Convention on the Law of the Sea (UNCLOS).

This article explores from the law of the sea perspective climate change impacts on the marine ecosystem and biodiversity in general and the challenges of accelerating rise in sea levels, in particular to baselines and maritime boundaries, and low lying states such as the Small Island Developing States (SIDS). It investigates possible responses with particular reference to UNCLOS in addressing the damages and assessing the extent to which potential means and mechanisms may be available to protect the affected states.

Specifically, the article examines what damages climate change as an imminent threat will cause to marine ecosystems and states' rights to maritime zones, and the submergence of low lying SIDS. This is followed by an analysis on whether and how the UNCLOS provisions pertaining to the protection and preservation of the marine environment, coupled with those relating to compulsory dispute settlement, may be of use in combating the climate crisis. The paper also touches upon whether a particular approach, such as climate litigation, could act against the projected *worst case* scenario to protect the affected states, and the challenges to such a course of action.

A. Introduction

The world's oceans cover more than 70% of the planet and contain a variety of natural resources vital to nearly every nation.¹ However, since the 1980s, global warming and the rise in sea levels have brought about significant negative consequences to the health of the ocean as a result of various forms of natural disasters and an increase of extreme events.² The low-lying coastal and islands states, particularly the SIDS, are likely to face some of the earliest and most severe climate change impacts over the course of this century with immense environmental, social and economic implications.³ These are recognised not only as challenges to the ecological system, but also as a “threat multiplier” of economic and social instabilities to sustainable development of humankind.⁴

As projected temperature increase accelerated, the scale of sea level rise and adverse threat to the world oceans has emerged as a planetary crisis going beyond environmental concerns. The climate change and its adverse impact, together with the search for measures to tackle such an overwhelming challenge have moved up to the top of the agenda amongst civil society, business and government, and cast strong influence to every individual state. There is an urgent need and mounting pressures for strong and focused global action to mitigate the negative climate effects. Unfortunately, it is a frus-

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- 1 The oceans comprise a complex, dynamic and vast component of the Earth's ecological system, second in size only to the global atmosphere. The oceans are a major provider of ecosystem services, food, mineral and other resources, and a major medium for global transportation and communication. For information on the importance of oceans and marine resources, see “Ocean Resources”: <http://marinebio.org/oceans/ocean-resources.asp>, last accessed 03 May 2013.
 - 2 In 2007, the Intergovernmental Panel on Climate Change (IPCC), established by the United Nations Environment Programme (UNEP), issued its Fourth Assessment Report of more than 3,000 pages. The most important conclusion of this report is that global warming is evident and that its highly probable cause is a greenhouse effect triggered by increasing concentration levels of greenhouse gases. In 2009, UNEP Climate Change Science Compendium reaffirms the strong evidence outlined in the 4th Assessment Report, and shows that climate change is accelerating at a much faster pace than previously predicted by scientists. For the IPCC reports, see http://www.ipcc.ch/publications_and_data/publications_and_data_reports.shtml#1, last accessed 03 May 2013.
 - 3 The United Nations (UN) defines *small island states* as islands with less than 10,000 square kilometers in land mass and with less than 500,000 inhabitants. For details, see <http://aosis.org/>, last accessed 03 May 2013.
 - 4 Kim (2010:101).

trating fact that the United Nations Framework Convention on Climate Change (UNFCCC)⁵ and its associated Kyoto Protocol,⁶ the current centre-pieces for multilateral action against climate change, are not capable of inducing significant participation and compliance mechanisms in curbing the growing concentrations of greenhouse gas (GHG) emissions causing the disaster.⁷ The international community has encountered enormous legal and political challenges in searching for means and mechanisms to protect the affected states. Against this background, the article examines how the real and potential impacts of climate change have affected the oceanic systems and the low lying states as SIDS, explore the viabilities of the UNCLOS as the 'Constitution for the Ocean' in implying a collective duty on the part of signatory states to implement strategies to combat climate change, and assess the extent to which possible cause of action may be sought for from the UNCLOS regimes to protect the affected states.⁸

As the primary instrument governing the oceans and the most comprehensive multilateral treaty ever concluded, the UNCLOS, adopted in 1982 and entered into force in 1994, comprises various norms of customary international law and legal rules pertaining to the oceans and applicable to relations between states.⁹ UNCLOS has 164 ratifications plus the European

5 The UNFCCC was adopted at the United Nations Conference on Environment and Development (the first *Earth Summit*) in Rio de Janeiro, Brazil, on 5 May 1992. It was opened for signature on 4 June 1992 and entered into force on 21 March 1994. Currently, it has 195 Parties. It provides a definition on climate change as: "a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods." For ratifications, see http://unfccc.int/essential_background/convention/status_of_ratification/items/2631.php, last accessed 03 May 2013.

6 The Kyoto Protocol to the UNFCCC was adopted on 11 December 1997, entered into force on 16 February 2005, and has 191 Parties. For ratifications, see http://unfccc.int/t/kyoto_protocol/status_of_ratification/items/2613.php, last accessed 03 May 2013.

7 Burns (2003).

8 The text of UNCLOS and relevant implementation agreements are available at <http://www.un.org/Depts/los>, last accessed 03 May 2013.

9 It is based on the four Geneva Conventions on the Law of the Sea adopted in 1958: Convention on the Territorial Sea and the Contiguous Zone; Convention on the High Seas; Convention on Fishing and Conservation of the Living Resources of the High Seas; and Convention on the Continental Shelf. They codified the customary international law. UNCLOS draws together the four conventions and made it the *old* law of the sea in a single unified treaty. States that have not acceded to UNCLOS may still be bound by the provisions of the four 1958 Geneva Conventions and the norms

Union as of 7 November 2012,¹⁰ which made it almost universally accepted.¹¹ Containing regimes on the exploration and exploitation of marine resources as well as provisions on the protection and preservation of the marine environment, the UNCLOS incorporates the desires and aspirations of the international community into a framework and makes it one set of rules for all states with greater potential than anticipated. Its framework in controlling pollution to the marine environment and mechanism for compulsory dispute settlement may be applicable to deal with the climate change crisis and to protect affected states.

B. Possible Effects of Climate Change on Marine Ecosystems and Environmental Implications

Climate change is typically discussed in global terms, yet its effects do not vary dramatically among different researching areas.¹² Compelling evidence from the current literature suggests that ecosystems are responding to temperature changes and increased carbon dioxide (CO₂) levels with significant impact on natural and coastal resources and national security.¹³ Recent research has strengthened the findings that climate change rapidly transforms the world's oceans by increasing the temperature and acidity of seawater, and alters atmospheric and oceanic circulation.¹⁴ Much literature has been published on both the predicted impacts and responses to it in terms of mitigation and adaptation.¹⁵ Predictions based on current scientific research and climate trends suggest an enormous challenge in two respects: continental glaciers will continue to melt, and sea levels will rise to one meter by the end of this century under "business as usual" scenarios.¹⁶ Thus, it is a settled fact that sea levels have been rising at an accelerating rate and are to rise

of customary international law. For details on UNCLOS and its related institutions, see http://www.un.org/Depts/los/convention_agreements/convention_overview_convention.htm, last accessed 03 May 2013.

10 For ratifications, see http://www.un.org/Depts/los/reference_files/chronological_lists_of_ratifications.htm#, last accessed 03 May 2013.

11 Koh (1982).

12 IPCC (2007e).

13 Elliott & Caballero-Anthony (2012:33).

14 Lubchenco (2008).

15 IPCC (2007d).

16 IPCC (2007c).

substantially in subsequent decades as a consequence of global warming regardless of any mitigation measures adopted. The oceans and marine ecosystems are under threat.¹⁷

I. Deteriorated Environment and Worsening Ecosystems

Climate change is undoubtedly the most serious environmental crisis facing the world today, and its impacts take many forms. The biggest existing one has been the ultimate threat of total biodiversity loss through global extinction due to a lack of ability of ecosystems and species to adapt to the rapid changes.¹⁸ This is because ecosystems, the biodiversity and services they support, are intrinsically dependent on climate.¹⁹ Temperature alteration and ocean acidification in magnitude and frequency will accelerate the potential impacts on biodiversity occurring in concert with other established stressors.²⁰

Plenty of scientific attention has looked at the physical impact and potential danger of ocean acidification on marine ecosystems. The observation data showed that coastal environment and marine ecosystems are intimately linked to climate and are vulnerable to increasing coastal populations, habitat loss, and anthropogenic pollution.²¹ With the rise in sea levels, coastal ecosystems, including tidal zones, estuaries and wetlands may migrate further inland resulting in habitat loss and fragmentation, invasive species, environmental contamination, and the species that utilise them will all experience impacts.²² Thus, acidification and temperature alteration are worsening the problems already occurring in the ecosystems, and directly affect the pattern of marine biodiversity. Extreme events, increasing in frequency and

17 More information on the importance of oceans and marine resources may be found online from Ocean Resources, <http://marinebio.org/oceans/ocean-resources.asp>, last accessed 03 May 2013.

18 As a planetary crisis, climate change and its catastrophic consequences result in not only rising sea levels, droughts and famine, but also the loss of up to a third of the world's plant and animal species. See Shah (2012).

19 Costanza et al. (1997).

20 Doney et al. (2012).

21 (ibid:13).

22 Staudinger et al. (2012:296).

intensity, put the ocean ecosystems under new combinations of stress, being described as “multiple jeopardy”.²³

II. Depleted Resources and Damaged Habitat

Oceans generate considerable economic wealth through fisheries, aquaculture, tourism and mining, and marine ecosystems provide irreplaceable services including coastal defence, oxygen production, nutrient recycling and climate regulation.²⁴ Fish are a precious natural resource of enormous ecological, social and economic value, and in many parts of the world, millions of people make their living from fishing, and for most of them fishing goes far beyond being just a source of income, it is a way of life.²⁵ Fish contribute to at least 50% of total animal protein intake in some SIDS.²⁶ Widespread physical changes to the ocean, including rapid warming sea waters and reduced calcification in ocean plankton and reef corals could result in a substantial decline in fisheries productivity in some regions, threaten coastal systems of low-lying estuaries and tidal flats, and impact the biological distribution of marine mammals and seabirds of both tropical and temperate species.²⁷

As “oasis in a marine desert” and “rainforests of the seas”, coral reefs cover an area of over 280,000 km² and provide home and shelter to over 25% of ocean fish and up to two million marine species, and a nursery for the juvenile forms of many marine creatures.²⁸ Coral reefs also provide numerous ecosystem services to benefit environment and humans, such as assisting in recycling the nutrients, protecting shores from the impact of waves and storms, serving as a vital input of food into the tropical/sub-tropical marine food-chain, and serving humans in the form of medicine and economic benefits to local communities from tourism.²⁹ Goods and services de-

23 Hofmann et al. (2010).

24 Crutzen & Stoermer (2000).

25 See WWF (2009:6).

26 In North and Central America 7.6% of animal protein is obtained from fish. In Europe fish supplies 11% of the protein needs, in Africa 19%, and in Asia 21%. For details, see FAO(2011) and <http://www.consvalmap.org>, last accessed 03 May 2013.

27 WBGU (2006:123).

28 Painting (2011).

29 Climate change has affected South China Sea Coral. See South China Sea Coral declined by at least 80% over the past 30 years, Hughes et al. (2012).

rived from coral reefs are roughly estimated to be between \$172 to \$375 billion dollars per year.³⁰

Coral reefs have extremely narrow temperature tolerances between 25-29°C, with some species in Pacific Islands currently living near their threshold of thermal tolerance. Rising ocean temperatures and increasing ocean acidification have negatively affected coral reefs in many parts of the world, to name a few, the Pacific and Indian Oceans, the Red Sea and Caribbean Sea, leading to the loss of 50% of the subsistence and artisanal fisheries owing to coral bleaching.³¹ Global threats to coral reefs have been increasing in the context of wider environmental degradation, so that the value of coral reefs may be even greater because they are integral to the well-being of the oceans, and loss of coral reefs may result in decreased net productivity and stunted growth in certain species.³² Rising sea levels will destroy vast areas of mangrove trees on the world's tropical coastlines and wipe out critical beach habitats (for sea turtles) that could adversely affect many species more directly.³³

III. Marine Geo-engineering Projects: Buried Troubles

One of the most pressing issues on the climate policy agenda is reducing CO₂ emissions. As an attempt to mitigate global warming, some projects have been proposed or are already being implemented worldwide that take the ocean as a great absorber and also a receptor of man-made CO₂ emissions.³⁴ Such projects, known as marine geo-engineering projects including carbon capture and storage (CCS) and ocean fertilisation (OF) have attracted great international attention.³⁵

CCS, also known as carbon capture and sequestration, is the process of capturing waste CO₂ from large point sources, transporting it to a storage site, and depositing it where it will not enter the atmosphere, normally an underground geological formation, as a potential means of mitigating global

30 For the value oceans provide, see <http://www.consvalmap.org>, last accessed 03 May 2013.

31 Andersson (2007).

32 Conservation International (2008:1-7).

33 Gilman et al. (2006).

34 IPCC (2005:77-88).

35 See Nolon (2012:204).

warming and ocean acidification.³⁶ OF has been suggested as a simple, quick, effective and environmentally friendly fix to the world's CO₂ emissions problems, but different views exist including that of the highly regarded IPCC which considers it as "speculative and unproven, and with risks of unknown side effects."³⁷

The expected outcome and potential impacts of CCS and OF have been hotly debated even regarded as buried troubles.³⁸ Concerns have been expressed over the potential risks of catastrophic results and the lack of international regulations in place to clarify allocation of environmental liability.³⁹ Questions are also asked about whether, how, and under what conditions, are they consistent with the law of the sea and other international conventions concerning protection of the marine environment and biological diversity?⁴⁰ To what extent humankind is permitted, as the law stands, to interfere with the marine ecosystem to mitigate the impacts of climate change? What have been or should be done to regulate such activities by international law?

IV. Environmental Implications: Ocean as the Last Resort

Climate change has reached us with many implications, from social, ecological, economic, to legal and environmental. The environmental implications are obvious and dreadful, particularly based on the adverse impact of global warming on marine living resources and detrimental effects of ocean acidification on marine ecosystem and biodiversity, as the ocean is our last resort for survival and existence.⁴¹ From a human perspective, the accelerating biodiversity loss risks human security, as there might be a major change

36 For discussions, see Rayfuse (2008).

37 See IPCC (2007c:15). See also Freestone & Rayfuse (2008).

38 Globally, 75 CCS projects are at various levels of development. For details, see Global Carbon Capture Storage (CCS) Institute (2012). For discussions, see Purdy (2006).

39 The relevant body of international law relating to CCS includes the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (the 1972 London Convention) and its 1996 Protocol. For international regulation development of CCS and OF, see <http://www.globalccsinstitute.com/>; and <http://www.ccsnetwork.eu/>, last accessed 03 May 2013.

40 For different views, see Purdy (2006); Nolon (2012); Ingelson et al. (2010).

41 See Zimmer (2011).

in the food chain, water sources and other resources we rely on.⁴² Edward O. Wilson believes that the loss of biodiversity is killing ourselves and the rest of life.⁴³ Mary Wood observes the evolution of international law and comments that “[h]umanity is violating nature’s laws not only at the level of individual species and ecosystems, but at the level of atmospheric functioning and ocean health – a truly global level.”⁴⁴ Indeed, the rapidly rising GHG concentrations are driving ocean systems toward conditions not seen for millions of years, with associated risks of fundamental and irreversible ecological transformation.⁴⁵

Changes in biological function in the ocean caused by anthropogenic change go far beyond death, extinctions and habitat loss, as fundamental processes are being altered.⁴⁶ The domino effect of the horrific path towards mass extinction of marine biodiversity and ecosystems is already showing negative impacts under current levels of climate change, and more frequent extreme weather events can be expected to have significant impacts on biodiversity.⁴⁷ In addition, the past half-century has seen an explosive growth in the size and number of marine dead zones, areas too low in dissolved oxygen to support life, and it is no coincidence that dead zones occur down-river of places where human population density is high.⁴⁸

The IPCC suggested that in the foreseeable future, the disastrous consequences of biodiversity loss are likely to be significant and many types of ecosystems will be altered or destroyed by the combination of global warming and conventional threats such as habitat destruction and pollution.⁴⁹ In the absence of stringent mitigation measures by the global community, climate change, as the keystone environmental issue of this generation and future ones, appears inevitable to continue apace. The existing biodiversity conservation strategies are of no effect under its mounting pressure. Without strategic action and updated law and policy, many of the global marine ecosystems will collapse. Fish stocks and coral reefs will only retain their

42 Shah (2012).

43 Wilson (2010).

44 Wood (2010:177).

45 For details, see Millennium Ecosystem Assessment, Findings (2005), available at <http://www.millenniumassessment.org/documents/document.359.aspx.ppt>, last accessed 02 May 2013.

46 Hoegh-Guldberg (2011).

47 Secretariat of the Convention on Biological Diversity (2010:56).

48 Diaz, & Rosenberg (2008).

49 IPCC (2007a:72–73).

productivity and diversity if sustainable development is ensured worldwide.⁵⁰ States need to recognise their interests in marine ecosystems, understand the importance and critical state of biodiversity, and address the problems of habitat degradation with concrete actions.

C. Possible Effects of Sea Level Rise on Baselines and Legal Implications

Historically, states had jurisdiction over a narrow strip of water adjacent to their coastlines and the remainder was regarded as *the high seas* that were free and open to all while belonging to no one.⁵¹ As new technologies made it possible to reach farther and deeper into the ocean to catch fish and to extract other resources, and as pollution of the oceans increased, states started a journey in establishing a legal framework to govern activities at seas.⁵² These efforts eventually led to the conclusion of the UNCLOS in 1982.⁵³ The most creative part of the UNCLOS is the establishment of various maritime zones by distance criteria measured from baselines. However, the rise in sea levels may bring serious challenges to this ‘Zonal Approach’, as it affects baselines systems from many perspectives, in particular, a state’s entitlement to maritime zones and resources therein, state relations due to maritime boundary delimitation, and territory loss due to submergence of base points. This section focuses on the sea level rise effects on baselines and legal implications to the UNCLOS regime.

50 WBGU (2006).

51 For general information on the development of the law of the sea, see Churchill & Lowe (1999).

52 (*ibid.*:12).

53 Details on law of the sea negotiation history and relevant documents are available at http://www.un.org/Depts/los/doalos_publications/doalos_publications.htm, last accessed 03 May 2013. See also Charney (1977).

I. States' Entitlement to Maritime Zones and Resources

UNCLOS divides the ocean into different types of zones measured from baselines.⁵⁴ The territorial sea, immediately adjacent internal waters,⁵⁵ with a breadth of 12 nautical miles (nm) from the baseline, is the zone which represents the seaward limit of the coastal state's sovereignty and concerns its airspace, sea bed, and subsoil.⁵⁶ The contiguous zone is a belt of sea contiguous to the territorial sea stretching for 24 nm from the baseline, in which the coastal state exercises jurisdictional powers in relation to its customs, fiscal, sanitary and immigration laws and regulations.⁵⁷ The exclusive economic zone (EEZ), adjacent to the territorial sea, is less than 200 nm.⁵⁸ The coastal state has sovereign rights in respect to environmental protection, scientific research, exploration and exploitation of natural resources.⁵⁹ The continental shelf constitutes the submerged prolongation of the coastal state's land territory and stretches for 200 nm from the baselines when the outer edge of the continental margin is less, or up to 350 nm (or 100 nm from the 2,500 meter isobaths) if it is wider.⁶⁰ The coastal state has sovereign rights over this area in respect to the exploration and exploitation of natural resources.⁶¹ The high seas are located beyond the external limit of the EEZ at a maximum of 200 nm from the baselines, and are not subject to the sovereignty of any state.⁶² Based on the UNCLOS regime, baselines serve a vital function in establishing literally all maritime zones and boundaries of a state.⁶³

54 UNCLOS, Article 5 specifies that the normal baseline is the low-water line along the coast as marked on large-scale charts officially recognised by the coastal state.

55 The internal waters locate on the landward side of baselines and are subject to full sovereignty of the coastal state. See UNCLOS, Articles 2(1)(2) and 8(1).

56 UNCLOS, Articles 2, 3 and 4. Foreign ships only have a right of innocent passage in the territorial sea and are bound to respect the national legislation of the coastal state on the regulation of maritime traffic, fiscal, immigration and environmental protection, marine scientific research, etc. See UNCLOS, Articles 17–22.

57 UNCLOS, Article 33.

58 UNCLOS, Article 57.

59 The other states have the freedom to overfly, navigate, and lay cables and pipelines on it. UNCLOS, Articles 56 and 58(1).

60 UNCLOS, Article 76.

61 Other states benefit from the freedom of the high seas on the continental shelf. See UNCLOS, Articles 56(1a) and 77(1).

62 UNCLOS, Article 86.

63 UNCLOS, Articles 57, 76(1) and (6).

When drawing the baselines, two situations need to be considered regarding which type of baseline is employed. The normal baseline, specified in Article 5, could be the low-water line following the natural configuration of the coast, whereas the straight baseline is drawn across coastal sections “joining appropriate points” on land following the configuration and curvatures of the coastline.⁶⁴ Thus, the juridical boundary between the land and the sea and of the territorial sea and the other zones will be parallel to the coast without extending the territorial sea unduly.⁶⁵ An island, if considered part of the coastal configuration, may provide a base point, in particular when a coast is made up of a cluster of fringing islands.⁶⁶

Based on the UNCLOS regime setting, sea level rise could substantially affect baselines and base points for measuring maritime zones. A shift in baseline could have profound implications on the greatest extent of a state’s entitlement to maritime zones and its economic and resources interests (fishing, sea-bed mining, etc.). The rising sea levels could change coastal formations, such as islands, and make the actual low-water lines and base points normally shift landward (*ambulatory*).⁶⁷ The outer limits of the territorial sea, contiguous zone, EEZ and portion of continental shelf claimed on the basis of distance from baselines also shift landward. Questions may arise if coastal features are altered or disappear; the seaward extent of the claims could decrease greatly along with the recessions.

As coastal states all have divergent interests to maritime zones, receding coastlines may lead to emerging issues regarding coastal states’ rights to marine resources in their maritime zones, whether living and non-living. UNCLOS Article 5 provides neither safeguards against sea level rise, nor provisions to specifically address the matter of determination of the normal baseline. In the context of climate change and the expected large-scale melting of ice,⁶⁸ a state would be partly deprived of the benefits of a territorial sea, and the idea that “it is the land which confers upon the coastal State a

64 UNCLOS, Article 7. A state may employ the method of straight baselines only in localities where the coastline is deeply indented and cut into, or if there is a fringe of islands along the coast in its immediate vicinity, across mouths of rivers (Article 9) and bays (Article 10). For discussions, see Scovazzi (2008–:para. 2).

65 United Nations Office for Oceans Affairs and the Law of the Sea (1989:para. 39).

66 UNCLOS, Article 7(3).

67 Attenhofer (2010:2).

68 See Vaughan & Spouse (2002).

right to the waters off its coast” is challenged.⁶⁹ This could impose a significant impact on the external limits of the maritime zones, particularly against low-lying coastal areas. As maritime zones recede, coastal states may in the worst of cases suffer from the loss of jurisdictions regarding the border of maritime zones and rights to essential marine resources, except for the maximum extent of outer continental shelf area which has to be established on the basis of the Commission on the Limits of the Continental Shelf (CLCS) recommendations.⁷⁰

Meanwhile, based on Article 76(9) of the UNCLOS, the outer limits of a continental shelf should be permanently determined by the CLCS. Article 7 provides that where, because of the presence of a delta, the coastline is highly variable, the appropriate points may be selected as a baseline. It also gives latitude for a coastal state to change the baseline to the extent that the change is made under the UNCLOS. There are no provisions permanently fixing the outer limits of the EEZ or even territorial seas. This may indicate that the legal and physical boundaries of the EEZ and territorial sea that are not touched upon by the UNCLOS are of a temporary nature.⁷¹

II. State Relations and Boundary Delimitation

The immediate importance of baselines is even more evident in maritime delimitation between adjacent and opposite States. With the current pace of sea level rise, many coastal states may witness a change in existing coastlines or submergence of base points. The receding or advancing coastlines and complete disappearance of low-lying islands/rocks may spark potential problems on maritime boundaries signifying extensive implications for the law of the sea and state relations.⁷²

69 The principle “the land dominates the sea” (North Sea Continental Shelf Cases, para. 96).

70 A unilateral delimitation of the outer continental shelf extends beyond 200 nm requires the submission of a claim to the CLCS under Article 76(8) for geological factor consideration. The CLCS, set up under Annex II of UNCLOS, can recommend the final and binding outer limits of the shelf in absence of overlapping claims or consent of the overlapping states has been given. See UNCLOS, Article 76 (4–6, 8, and 10).

71 Roach & Smith (1994:67).

72 For a fuller account, see Caron (2008:17) and (1990).

With the looming unprecedented rise of sea-levels, the settlement of maritime delimitation disputes may gain a new incentive. It should be noted that the rules on straight baselines are not affected by the provision in Article 121(3) that rocks which cannot sustain human habitation or economic life of their own shall have no EEZ or continental shelf. The interesting question of distinction between rock and island may relate to economic interests of coastal states. Apart from oil and gas, there may also exist a genuine and remarkable interest in the natural resource of fisheries, which may be relevant to the drawing of baselines.⁷³

Since baselines may become a more sensitive issue and states may be advised to move toward fixing ocean boundaries on the basis of presently accepted baselines, an important issue pertaining to this situation is whether maritime boundaries may be subject to continual modification depending on coastline changes. The consideration of baselines from which the outer limit is measured is a legal matter, and can be established unilaterally, however, the delimitation of maritime boundary has always been an issue of international relevance, as it may affect the neighbouring states' rights and interests.

Guidance on maritime delimitation for the new challenges needs to be provided in the context of rising sea levels. In the process of negotiating boundaries, states should bear in mind the present law on maritime delimitation without regard to the migrating baselines. States might contest the maritime boundaries between or among themselves, even the recommendations of the CLCS on the basis of disputed unilateral baselines.⁷⁴ Also, a unilateral delimitation of the continental shelf beyond 200 nm can be a reduction of the Area that is reserved as "common heritage" for mankind, and could be contentious owing to rich natural resources on the seabed and in the subsoil.⁷⁵

73 Churchill (2008—:para. 1).

74 Globally, over 400 bilateral boundaries need to be delimited, only less than one third has been settled. For submissions of the outer limit of continental shelf, see http://www.un.org/Depts/los/clcs_new/clcs_home.htm, last accessed 03 May 2013.

75 The regime regarding *Area* is set forth in Part XI of UNCLOS. Appropriation by any state of any part of the Area is explicitly prohibited and no such claim or exercise of sovereignty or sovereign rights shall be recognised. See UNCLOS, Article 137.

III. Territorial Entitlement and Uncertain Status

As defined in the UNCLOS, all maritime zones are measured from a baseline. Accordingly, any movement of such baseline will lead to a change in maritime boundaries. If a base point such as an exposed rock disappears, it may be claimed that the boundary based on such a point has moved or disappeared. The UNCLOS does not explicitly stipulate that the boundary should be moved together with a base point. Facing unprecedented changes on the scale of coastline and maritime boundaries,⁷⁶ it is necessary to consider different submerging scenarios of an island or rock belonging to a state and critical effects occurring to the types of baselines regarding which an issue may be raised owing to the rising sea level while considering legal implications and possible solutions.

The types of baselines regarding which an issue may be raised owing to the rising sea level include low-tide elevations, fringing reefs, islands, and river banks. Under Article 13 of the UNCLOS, a low-tide elevation may be used as the baseline. However, if such low-tide elevation is submerged permanently by rising sea level, the state concerned may lose the territorial seas accorded by such base point.⁷⁷ At the same time, “[a]n island is a naturally formed area of land, surrounded by water, which is above water at high tide”.⁷⁸ The provisions differ only with regard to the dry or submerged status at high tide. Low-tide elevations therefore “literally do not rise to the status of islands”.⁷⁹ According to Article 121 of the UNCLOS, an island is entitled to the territorial sea, contiguous zone, continental shelf, as well as a 200 nm EEZ. Rising sea levels may submerge an island in part or entirely. Where an island is no longer regarded as such due to its submerged status at high-tide, it will only be considered for measuring the maritime entitlements, if it lies within the territorial sea.⁸⁰ Where, however, a low-tide elevation (or former island) lies at a distance exceeding the breadth of the territorial sea from the mainland or a ‘real’ island, it has no territorial sea of its own.⁸¹

76 Kim (2010:101).

77 UNCLOS, Article 13(1).

78 UNCLOS, Article 121(1).

79 Roach & Smith (1994:73).

80 The court in Qatar/Bahrain held that “there [is no] doubt that a coastal State has sovereignty over low-tide elevations which are situated within its territorial sea, since it has sovereignty over the territorial sea itself, including its sea-bed and subsoil” (para. 204).

81 UNCLOS, Article 13(2).

With the rising sea levels, the nature of some insular features will invariably change from island to low-tide elevation, which could indicate massive losses to resource rich maritime zones.⁸² Under such circumstances, it may be the case that any affected island state is deprived of the right to use a part of the island for expansion of its EEZ. The situation is unsatisfactory where former islands, lying outside the territorial sea, once had the sovereignty of a state and accordingly could be used to generate a territorial sea of their own.⁸³ The question thus arises if the concepts of sovereignty and appropriation should apply to low-tide elevations which had once been islands.

In the case of islands surrounded by reefs, the baseline for measuring the breadth of the territorial seas is the seaward low-water line of the fringing reefs. Accordingly, a rise in sea level may change the scope of the territorial sea of such islands. The entitlement to maritime zones beyond the territorial sea does not apply if an insular feature is not an island in the sense of paragraph 2 but a rock in the sense of paragraph 3 of UNCLOS Article 121. Rocks which cannot sustain human habitation or economic life of their own shall have no EEZ or continental shelf.⁸⁴ These criteria have been debated for lack of clarity in distinguishing rocks from islands.⁸⁵ Being mixed with the sea level rise, the island versus rocks criteria will almost inevitably be complicated and causing more confusion in state practice about their legal status and entitlement.⁸⁶

With respect to river banks, UNCLOS Article 9 provides that if a river flows directly into the sea, the baseline shall be a straight line across the mouth of the river between points on the low-water line of its banks. However, river banks are susceptible to constant erosion and sedimentation, which may subsequently cause changes in the maritime zone determined on the basis of river banks. It is getting more important and vital to make clear distinction between islands, low-tide elevations or even reefs as it may become particularly contentious in the event that sea levels should rise rapidly.

82 (ibid.).

83 UNCLOS, Article 13(1).

84 UNCLOS, Article 121(3).

85 The ability of rocks to sustain human habitation or economic life of their own may be altered in the course of economic development, possibly fuelled by technological advancement. Many rocks thus have a potential capacity to host at least some human population or produce some economic activity. See Dipla (2008—:para. 8).

86 For a discussion on this, see Xue (2011).

IV. Legal Implications: Solutions to Resolve Potential Conflicts

The temporary nature and legal uncertainty of maritime boundaries are not desirable, since they have the potential to intensify existing conflicts over marine resources or trigger new ones. This problem may appear not so significant compared to the humanitarian challenge but it is of undeniable importance since it brings in its wake a whole series of geopolitical and economic consequences, especially in the current context where natural resources are becoming increasingly rare. They could pose a threat to world peace if they are not wisely negotiated and carefully managed.

With the ambulatory nature of baselines, numerous legal issues are raised, among which, determining the extent of rising sea levels on baselines and boundary delimitation are the core ones. In order to prevent such dispute, some scholars suggested a change of great importance as the formulation of strict procedures to officially modify a maritime boundary and to guarantee firm expectations of interests to all states concerning a maritime boundary.⁸⁷ It is worth mentioning that the drawing of baselines is necessarily a unilateral action, however, the validity of the delimitation with regard to other states depends on international law.⁸⁸ As the states concerned take different stances, it is advisable to settle maritime boundary delimitation on a permanent basis with defined geographical coordinates by bilateral agreements.⁸⁹

Proposals are also made for the affected states to fix or freeze presently accepted baselines and/or outer limits of maritime zones where appropriate.⁹⁰ A coastal state may announce the baselines established in accordance with the UNCLOS as permanent once it has deposited the geographical coordinates with the UN on an adequate scale with due publicity, notwithstanding subsequent changes in geographical features of coasts or islands due to sea level rise. The reality is that the totally submerged islands (disappeared) may cease to generate any maritime zones, and the partial submerged ones may become rocks that are not entitled to an EEZ or continental shelf. More importantly, only states can claim maritime zones, therefore

87 Caron (2008).

88 Kwiatkowska (2007:944).

89 According to UNCLOS, Articles 5 and 16(1), to declare baselines by recourse to geographical coordinates may require amendment of domestic legislation.

90 Such proposals include fixing of baselines by Caron (2008), fixing of outer limits by Soons (1990), Freestone & Pethick (1994).

when a state ceases to exist, maritime zones cease and may revert to global commons or to other states.

To avoid uncertainty and possible conflicts under the situation of constant rising sea levels, it may be necessary to promote the adoption of universal rules by means of a multilateral agreement or an international organisation to protect the affected baselines drawn in accordance with UNCLOS to make it permanent from the time they are publicly declared.⁹¹ Although this is deemed to be very difficult, it is a task of legal scholarship to aid societal adaptation to global climate change by identifying and addressing legal challenges.”⁹²

D. Possible Effects of Sea Level Rise on Low Lying States and Legal Remedies

While the unfolding, collectively-induced climate crisis is having significant impacts on the world’s oceans and marine ecosystems, humankind is also to subject to its associated environmental damages and severe consequences.⁹³ Indeed, its global nature and capacity to hinder sustainable development is reflected from the most striking examples of its human impact on low lying states, typically the SIDS who are already poor and vulnerable with the weakest capability to bear the profound challenges and additional burdens.⁹⁴

I. De-territorialised States and Climate Exiles

The effects of rises in sea level and the threats this poses for low lying coastal states have been the subject of extensive study and commentary since the 1980s. More than half of the world’s population lives in coastal areas, and the accelerating sea level rise imposes serious adverse human impacts in a

91 This may be done to be based on the procedural mechanisms to develop customary international law, draft a Protocol to UNFCCC, formal amendment of UNCLOS, or UNGA Resolution (PART XI approach).

92 Caron (2008).

93 Pernetta (1992).

94 For more information on this account, see Small Island Developing States Network at <http://www.sidsnet.org/>; for Environmental Vulnerability Index, see <http://www.vulnerabilityindex.net>, last accessed 03 May 2013.

variety of ways.⁹⁵ As the effects of climate change intensify, the coastal and island communities of the low-lying Pacific SIDS are especially endangered.⁹⁶ They may lose not only their homes, but their entire nations, and will be forced to leave their homes within the next half-century.⁹⁷ In the worst scenario, some extremely vulnerable SIDS such as Maldives, Tuvalu, Marshall Islands and Kiribati⁹⁸ will suffer from partial or total loss of submerged territory and become the victims of climate change as de-territorialised states and climate exiles.⁹⁹

Although there is no comprehensive review of present and projected climate change impacts on the SIDS as a whole, there is no great gap and difference about the influence of climate risk on SIDS.¹⁰⁰ The SIDS, comprising 52 small countries and territories in the tropics and low-latitude subtropics, are the least responsible for GHG emissions, yet are likely to suffer

95 Burns (2001).

96 A rise in sea level of only one meter would allegedly destroy a large portion of Bangladesh, 75% of the low-lying islands in Vanuatu and 80% of the Majuro Atoll of the Marshall Islands, and inundate residential areas for half of the public. Ghina (2003a) and (2003b:7).

97 Park (2011).

98 Tuvalu, a small island state in the South Pacific Ocean with an average altitude of less than 3 meters, risks being wiped off the map in the next decades. Kiribati is seriously contemplating moving their inhabitants on to floating islands constructed on the model of giant oil platforms. Tuvalu and three other small Pacific island nations (Fiji, Kiribati, and Nauru) have contemplated a lawsuit, as evidenced by their declarations upon signing the UNFCCC in 1992 that preserved its right to seek legal redress for damages allegedly suffered as a result of climate change. See <http://www.aosis.org>, last accessed 03 May 2013 for more information and the full Declaration.

99 Under international law, refugees are strictly considered to be those who have been forced to flee their homes countries as a result of war or persecution and have the possibility of return when things get better in the future. They seek asylum under the condition that they cannot obtain protection from their own state; often their own state is responsible for their vulnerable situation. But when a person's home, land or indeed entire country is wiped out by a phenomenon such as rising seas there is no hope or chance that the person will ever be able to return home. Such individuals will therefore essentially have become 'climate exiles' who will have no legal status and few options other than to become permanent boat people unless the international community develops early strategies to address their legal needs. For discussions, see Kelman, & West (2009); Kelman (2011); Dore (2005:1168).

100 Lewis (1999).

the worst effects, and be disproportionately burdened by climate change.¹⁰¹ They are ecologically fragile and vulnerable owing to their small size, limited resources, geographic dispersion that put them in a disadvantaged position in sustainable development.¹⁰² Many residents or settlements of such states suffer from extreme weather events like storm surges and other hazards, of increased frequency and intensity.¹⁰³

Of course, they are not the only small island nations that suffer damages from climate damages, many other states are suffering from sea level rise which is causing adverse impacts.¹⁰⁴ From coral atolls in the Pacific Ocean to low-lying coastal states to landlocked Himalayan nations, scores of such states are positioned as climate change victims.¹⁰⁵ In Bangladesh alone, people migrating in response to climate change could outnumber all current refugees worldwide.¹⁰⁶

II. The Statehood Dilemma and Compensation Challenges

In the light of wide-ranging effects of current global warming and sea level rise, two broad policy responses have been adopted in addressing the negative impacts. One is *mitigation*, which searches for actions aimed at slowing down climate change by reducing net GHG emissions, the other is *adaptation*, which seeks for actions taken in response to, or in anticipation of, projected or actual changes in climate.¹⁰⁷ While scientists, managers and resource users work actively to design adaptation strategies that reduce the vulnerability of marine species, systems and industries to climate change, legal scholars have been trying to search for means of possibilities to legally

101 A List of Small Island Developing States (UN and Non UN Members) is available at <http://www.un.org/special-rep/ohrlls/sid/list.htm>, last accessed 03 May 2013; Ghina (2003a).

102 Lewis (1990). See also Wisner et al. (2004).

103 IPCC (2007b:18).

104 The Alliance of Small Island States, an intergovernmental body established in 1990 to address global warming and negotiate within the UN system, has 37 members, 36 of which are UNCLOS states parties.

105 Voccia (2012).

106 Based on an estimate that includes anyone who was foreign-born in their current country of residence, migrants worldwide make up about 175 million people. See Hinrichsen (1998); Lewsey & Kruse (2004).

107 Dang et al. (2003).

maintain the statehood and maritime entitlement of the affected states in the event of inundation.¹⁰⁸

Questions have been raised about who will bear the costs of adaptation measures of the affected states and who has to pay for the damages and compensate the climate exiles for their loss of homelands and property, the damage to their health and life?¹⁰⁹ How can these states be better protected through the path of international legal remedies with regard to states' responsibilities and environmental liability? However, current international law does not adequately address the statehood dilemma and continued maintenance of their entitlements in the context of sea level rise. The cross-cutting issues of climate exiles link to many areas of key interests of those dislocated people, including development, national security, and human, indigenous, and cultural rights.

The emerging issues relating to the statehood dilemma and climate exiles are particularly pressing in the context of vulnerable SIDS whose very existence is threatened. In an attempt to build pressure to force states to take action on climate change, a widespread consensus on the need for international legal protection of climate migrants has emerged by turning to the courts as a means and strategy to bringing about major change and promote greater action to address the adverse impacts,¹¹⁰ and to seek to hold those responsible for GHG emissions accountable for the impacts of their past and future actions.¹¹¹

To rescue their 'disappearing' territory and statehood, the SIDS have also been trying to seek assistance from international law for adaptation, stability,

108 1994 Report of the Global Conference on the Sustainable Development of Small Island Developing States. Document A/CONF.167/9 (October, 1994) from the Global Conference on the Sustainable Development of Small Island Developing States, Bridgetown, UN, 25 April – 6 May 1994.

109 Legal issues have been raised and suggested concept recognition of new category of state as de-territorialised state in international law. For details, see Rayfuse (2010).

110 Climate litigation is a relatively new phenomenon, but recent decisions in Australia ruling in favour of the arguments of environmental applicants suggest that it is a trend that will only continue to grow in the coming years. See Peel (2007:103).

111 According to Vicuña (1998:280), "responsibility and liability for environmental damage should not always be regarded as a negative sanction, but rather...as a positive inducement to prevention, restoration or compensation as the case may be."

and a future,¹¹² whereas, the issue regarding to international legal remedies for the affected states has been hotly debated. Views are divided regarding whether international law offers a possibility for states injured by climate change-related impacts to claim, and be awarded, compensation for the damage suffered, and to what extent the GHG emitting states are responsible to compensate the injured states.¹¹³

The literature reveals regrettably that international attempts to hold emitters accountable have not been successful. Tuvalu's threat to sue the United States and Australia at the International Court of Justice, and the Inuit's petition to the Inter-American Commission on Human Rights were both hampered by procedural and substantive legal issues.¹¹⁴ This indicates the need for a holistic and proactive approach along? the progress to enhance the linkages between climate damages and legal remedy for the affected states to find a solution to protect states as SIDS for their loss in statehood and maritime zones.¹¹⁵

112 A group of SIDS, headed by Palau, asked the UN General Assembly to seek an advisory opinion from the International Court of Justice on the legal responsibilities of nations whose corporations cause international harm through contributing to climate change. See International: Palau to seek ICJ Advisory Opinion, available at <http://www.climatelaw.org/cases/country/intl/icj/palau>, last accessed 03 May 2013. UN Department of Public Information, Advisory opinion on climate change, 03 February 2012, at http://www.un.org/News/briefings/docs/2012/120203_ICJ.doc.htm.

113 Vicuña (1998).

114 Weinbaum (2011) holds the view that tort law and human rights-based litigation may not be the most effective approach to meet the immediate needs of SIDS' facing the dire consequences as climate victims.

115 For the first time, nations agreed at the UN climate conference in Qatar that "developing nations that are particularly vulnerable to the adverse effects of climate change" and might have a right to redress from major polluting nations for any resulting "loss and damage." The IPCC directed its staff to begin research on how to ensure that redress. The new diplomatic language about "loss and damage" adopted in Qatar signifies that there has been a potential breach of the UNFCCC agreement. And that breach can only intensify the demand for the responsibilities of states to be defined in law. The latest action taken in Qatar suggests nations now concede that damaging impacts of climate change are inescapable.

III. Legal Remedies and Litigation Strategy

Customary international law has a fundamental principle that states may do each other no harm.¹¹⁶ A state violates this rule if an activity under its control does damage to another state, and if it is done on purpose or due to carelessness. Impacts of climate change fall under this rule, as reinforced by many declarations and treaties including the UNFCCC and Kyoto Protocol.¹¹⁷ Given the failure of the world's major greenhouse gas emitting nations to meaningfully address climate change domestically or through international regimes, there is a rise in plans for litigation worldwide for consequences of global warming and sea level rise.¹¹⁸

The vision of litigation may help to deepen the commitment of states to confront this pressing issue as an important mechanism for raising public, political and commercial awareness. Equally great is the possibility that litigation could be an alternative for many states that may bear the brunt of climate impacts during this century and beyond, and its significance extends beyond the court room.¹¹⁹ On the other hand, as a common challenge to all litigation is establishing legal causation, litigation of this kind is complex due to the nature of the science and the facts of climate change, and it involves interrelated legal and scientific issues and touches upon many different aspects of international and domestic law. Climate change law and policy regarding state responsibility under UNFCCC and Kyoto Protocol,¹²⁰ as currently organised, are being constructed at the intersection of several areas of law, including international law, environmental law, energy law, and business law, and are ill-equipped to deal with an inherently cross-

116 The *no harm rule* is a rule of customary international law that declares a state has a duty to prevent, reduce and control the risk of environmental harm to other states. The rule has been applied in many cases and is included in international agreements, such as the Declaration of the United Nations Conference on the Human Environment. See Schwarte (2012).

117 For discussions on this, see Brownlie (1983); Churchill & Freestone (1991); Freestone & Hey (1996); Yamin & Depledge (2004).

118 United Nations Economic and Social Council (2011); United Nations General Assembly (1994); Report of the International Meeting to Review the Implementation of the Program of Action for the Sustainable Development of Small Island Developing States. A/CONF.207/11, Port Louis, Mauritius, 2005.

119 Wiggins (2007).

120 McAdam (2009).

cutting issue like climate change and litigation.¹²¹ It is likely to be challenging to establish that the emissions of a single defendant are significant enough to be regarded as having caused the damage suffered, and may have to take a while before climate change actions are instituted.

At the mention of environmental liability, the *polluter pays principle* does play a crucial role,¹²² but the difficulty may lie in the fact that compensation for the harm done depends on many parameters, such as emission scenarios, climate change impacts and its accounting. For example, coral reefs face many other threats that may also contribute to their degradation, including disease, predators, and pollution. Thus, it may be difficult to attribute damages solely, or even substantially, to the degradation of reefs. It would be difficult for the small and vulnerable states to provide evidence for such links. Likewise when a party facing such an action in dealing with GHG emission responsibility for marine damages to the emissions of any individual country, it might have to argue that all other responsible parties must be brought into the dispute.¹²³ Given the difficulties to make a successful claim, the most crucial issues are from when countries can be held responsible and which emissions are acceptable and which careless.¹²⁴ The effectiveness of this strategy for achieving climate goals is further limited by the time and expense of litigating, the restrictions inherent in environmental law, administrative challenges, and the possibility that judicial decisions may be overruled by the legislature.¹²⁵

Nevertheless, this does not mean that there are no means available to serve as legal remedies for the states affected. There is a long standing body of international instruments concerning damage caused by nuclear activities, as well as in the field of oil pollution at sea.¹²⁶ More recent instruments deal with damage caused by maritime transport of hazardous and noxious substances.¹²⁷ Operational procedures of these actions will lend strength to the

121 The traditional ways in which law and policy have been divided into fields of inquiry and operation, such as human rights, trade, development and so on, do not reflect the messy, complex interconnectedness of the issue. Dernbach & Kakade (2008).

122 Ingelson et al. (2010:456).

123 See Draft Articles on Responsibility of States for International Wrongful Acts (Article 47). International Law Commission, 2001, available at http://www.un.org/la/w/ilc/texts/State_responsibility/responsibilityfra.htm, last accessed 03 May 2013.

124 Myles (2003:892).

125 Bach & Brown (2009); Tol & Verheyen (2004:1111).

126 Basse (2009:36).

127 (*ibid.*).

formation of climate litigation. With the rising tide of international climate litigation, the business as usual mentality and environmental unresponsiveness will soon become a thing of the past. The possibility of a small island state, or another injured party, bringing a liability claim against states responsible for climate change will no longer be a topic for fiction or a theoretical prospect. What remains is to muster the political will necessary to turn potential solutions into reality.

E. The UNCLOS Regime and Protection of Affected States

Facing the critical changes occurring in the oceans and disappearing low lying states, how to address the climate change damages and find practical solutions to support the affected states, has become arguably the most pressing legal, environmental, political, economic, social and ethical issue of our time.¹²⁸ This section looks into the UNCLOS regime in controlling pollution of marine environment and settling disputes with special attention to its potential in protecting the affected states.

I. "Pollution" Definition and GHG Inclusion

The UNCLOS, comprising 320 Articles and nine annexes, establishes a comprehensive framework for the world's oceans governing all aspects of ocean matters, particularly on how the living resources of the oceans are managed and marine pollution is regulated so as to protect coastal states' vital economic and environmental interests. Concerning the "Protection and Preservation of the Marine Environment", a regime is set forth in Part XII with obligations being emphasised to prevent, reduce and control pollution literally from all sources, i.e. land-based sources, from sea-bed activities, from activities in the Area, by dumping, from vessels, and from or through the atmosphere.¹²⁹ UNCLOS sets up rules of jurisdiction that clarify where and how states parties adopt domestic laws and regulations, international environmental standards and other measures to control pollution for the

128 Wiggins (2007).

129 UNCLOS, Articles 207 to 212.

health of the oceans and the living resources, and that must be no less effective than the “global rules and standards”.¹³⁰

As one of the most important instruments and widely ratified multilateral treaties, its provisions on environmental protection by themselves would constitute a critically important environmental treaty to protect the physical health of the ocean, also the living resources therein. This is reflected from how the term is defined on “pollution of the marine environment” to mean¹³¹

the introduction by man, 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.

There is no direct reference to climate change in this definition, no indication in forming a basis for ocean damage compensation. Nevertheless, it makes clear that any “substances or energy” introduced by human activities, either directly or indirectly, into the marine environment resulting in “deleterious effects as harm to living resources and marine life” constitute the pollution of the marine environment. Through this expansive definition, GHG emissions from or through the atmosphere appear to be pollution covered under its regime.¹³²

As discussed earlier, evidenced from scientific findings, the accumulation of CO₂ has resulted in the temperatures and acidification increase of sea waters that has caused damage to marine living resources such as corals and the habitat. The rising sea levels have also brought negative consequences to the livelihood and very existence of low lying states. These manifestations

130 UNCLOS, Article 210.

131 UNCLOS, Part 1, Article 1(4).

132 This may find support from the United States Environmental Protection Agency (EPA) action in regulating GHG under the Clean Air Act from mobile and stationary sources of air pollution in 2011. See *Massachusetts v EPA*, 127 S. Ct. 1438 – Supreme Court 2007: 127 S. Ct. 1438 (2007), *Massachusetts et al., Petitioners, v Environmental Protection Agency et al.* No. 05-1120. Supreme Court of United States. Argued 29 November 2006. Decided 02 April 2007. For actions taken by the EPA to regulate GHG, and steps planned to complete emissions rules, see Environmental and Energy Study Institute. Fact Sheet: Timeline of EPA Action on Greenhouse Gases, available at http://www.eesi.org/epa_ghg_timeline_070711 last accessed 03 May 2013.

may give rise to actions under the UNCLOS.¹³³ Similarly, UNCLOS makes no direct mention of the impermissibility of geo-engineering measures in general or CCS and OF in particular, its definition would prohibit such activities because of their potential risks of deleterious effects to the marine environment.¹³⁴

Such an expansive definition was said to have originated from a series of drafts and proposals embodying a comprehensive approach and reflecting principles adopted in the 1970s by the international community including the UN Conference on the Human Environment (the Stockholm Conference)¹³⁵ and “the consensus that pollution from all sources should be dealt with, in relation to a broad, indeed all embracing, concept of ‘marine environment.’”¹³⁶ The concept is consolidated by concrete efforts through 46 Articles of Part XII and relevant provisions of other parts prescribing specific duties for states to protect and preserve the marine environment.¹³⁷

II. Marine Environmental Protection and GHG Emission Reduction

Articles 192–237 in Part XII of the UNCLOS set out rights and duties of states in controlling pollution with appropriate care and formulates a comprehensive set of regime marine environmental protection.¹³⁸ Under the UNCLOS, states are required to undertake all measures necessary “to prevent, reduce and control pollution of the marine environment from any source,”¹³⁹ including “the release of toxic, harmful or noxious substances, especially those that are persistent¹⁴⁰... from land-based sources, [or] from

133 Burns (2006).

134 See Duhaime Legal Dictionary on *Pollution*, available at <http://www.duhaime.org/LegalDictionary/P/Pollution.aspx>, last accessed 03 May 2013.

135 The Stockholm Declaration came out of the 1972 Stockholm Conference on the Human Environment, often considered the progenitor of the modern environmental movement. Principle 21 of the Declaration is most apposite. For details, see <http://www.unep.org/Documents.Multilingual/Default.asp?documentid=97&articleid=1503>, last accessed 03 May 2013.

136 See Nordquest et al. (1991:55).

137 UN Secretary General, *Law of the Sea: Protection and Preservation of the Marine Environment*, UN Doc. A/44/461, 1989, para. 30.

138 Hafetz (2000:596).

139 UNCLOS, Article 194(1).

140 UNCLOS, Article 194(3).

or through the atmosphere....”¹⁴¹ UNCLOS is significant in adopting a different approach to the classification of the various pollution sources that should be regulated by international rules and national legislation to prevent, reduce and control pollution of the marine environment. It is a departure from previous international regulations of this kind.¹⁴²

Among the listed sources of pollution, pollution from or via the atmosphere is specifically dealt with in Article 212 and other places in Part XII of the UNCLOS where states are required to adopt laws and regulations applicable to the air space under their sovereignty and to vessels flying their flag or vessels or aircraft of their registry, taking into account internationally agreed rules, standards and recommended practices and procedures to prevent, reduce and control pollution from or through the atmosphere.¹⁴³ In addition to fulfil their duty to protect and preserve the marine environment, states are further required to ensure that activities under their jurisdiction are conducted in a manner that does not cause pollution damage to other states and their environment.¹⁴⁴ It emphasises that all necessary measures need to be taken to ensure transboundary harm should be avoided.¹⁴⁵ This provision is particularly relevant to GHG emissions. Collectively with the *pollution* definition, it implicitly prohibits any “substances and energy” that may cause pollution to the atmosphere including unlimited emissions of GHG. In this regard, the UNFCCC and Kyoto Protocol also provide a framework as the most important obligation for substantive international action in reducing the GHG emissions and potential climate damages to the oceans.

Moreover, Article 197 of the UNCLOS requires parties to cooperate through competent international organisations to formulate rules, standards, and practices to protect and preserve the marine environment.¹⁴⁶ Parties are

141 UNCLOS, Article 194(3)(a). See also Article 212.

142 Such as the International Convention on Pollution of the Sea 1954 by Oil and MARPOL 73/78 which concerned only operational/accidental discharges of vessel-sourced.

143 UNCLOS, Articles 207, 208, 209, 210, 211, and 212(1).

144 UNCLOS, Article 193.

145 UNCLOS, Article 194(2).

146 The International Maritime Organisation (IMO) is one of such competent international organisations, a specialised agency of the UN responsible for measures to improve the safety and security of international shipping and to prevent marine pollution from ships. It also is involved in legal matters, including liability and compensation issues and the facilitation of international maritime traffic. Marine environment protection is one of its strong focuses. It develops global regulations,

also obligated under Article 204 to act directly or through competent international organisations to monitor the risks or effects of pollution of the marine environment, and to keep under surveillance the effects of any activities which they permit or in which they engage in order to determine whether these activities are likely to pollute the marine environment. As a reflection of UNCLOS “as strict as possible approach”, this requirement has also been adopted in recent decades by the international community in the form of the *precautionary principle* with implications to states that produce GHG emissions.¹⁴⁷ In the same fashion, Article 212 is also pertinent where it requires parties to act through competent international organisations or diplomatic conferences to establish measures to prevent, reduce, and control pollution. The UNFCCC should clearly be analysed as such “competent organisation” to address climate change given the fact that it has been ratified by 195 parties, including all of the world’s major GHG emitting states.¹⁴⁸ The obligations under UNFCCC should be recognised as “international mechanisms to control pollution” under Article 212 of UNCLOS, since its overarching purpose is to control GHG emissions so as to “prevent dangerous anthropogenic interference with the climate system.”¹⁴⁹

It is noteworthy that whilst some UNCLOS provisions set regulatory standards for the protection and preservation of the marine environment, Articles such as 213–222 and 235 are rules for those standards to be enforced. In particular, Article 235 explicitly deals with state responsibility and liability for the fulfilment of their international obligations concerning the protection and preservation of the marine environment. Under Article 235, state responsibility is triggered when it fails to fulfil the responsibilities provided by the UNCLOS, and states need to ensure available recourse for prompt and adequate compensation or other relief in respect of damage caused by pollution of the marine environment. With the objective of assuring prompt and adequate compensation, states are to cooperate in the implementation of existing international law and to further develop international law relating to responsibility and liability for the assessment of and compensation for

adopts treaties and guidelines at the intergovernmental level, and member governments are responsible for implementing and enforcing the adopted regulatory framework. For details, see <http://www.imo.org>, last accessed 03 May 2013.

147 For general discussions, see Freestone & Hey (1996).

148 See http://unfccc.int/essential_background/convention/status_of_ratification/items/2631.php.

149 UNFCCC, Article 2.

damage and the settlement of related disputes, and develop criteria and procedures for payment of adequate compensation, such as compulsory insurance or compensation funds.¹⁵⁰

This imposes a very stringent standard of care in mandating states' obligations and liabilities as juridical persons in accordance with international law.¹⁵¹ It also secures the linkage between Article 235 and the UNFCCC regime. The latter is clearly an international obligation that can contribute to the protection and preservation of the marine environment by reducing GHG emissions. Indeed, the UNFCCC specifically acknowledges the potential impacts of climate change on natural ecosystems,¹⁵² and the need for special regard of countries with fragile ecosystems.¹⁵³ Article 304 also affirms that a state is responsible and liable for damage to the marine environment.

Another such linkage rests between UNCLOS and other environmental treaties represented by the 1972 London Convention and its 1996 Protocol, which substantially increases the viability of UNCLOS to reduce GHG damages to the marine environment.¹⁵⁴ One of the important consequences lies in the fact that parties to either UNCLOS or the London Convention/Protocol are obligated to the "global rules and standards" referenced by Article 210 that provides the foundation for regulation of dumping activities including CCS and OF types of marine geo-engineering projects.

Under Article 210 (6) of the UNCLOS, the national laws, regulations and measures of a state shall be no less effective in preventing, reducing and controlling pollution than the global rules and standards, which implicitly

150 UNCLOS, Article 235(3).

151 UNCLOS, Article 235.

152 UNCLOS, Preamble.

153 UNCLOS, Article 2(8g).

154 UNEP lists over 500 agreements between or among states that deal with environmental issues out of 40,000 total international agreements, see <http://unfccc.int/documentation/documents/items/3595.php>. International agreements to protect the marine environment include: International Convention for the Prevention of Pollution of Ships (MARPOL 72/78 adopted in 1973 and updated with a 1978 Protocol); Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, 1972 (the "London Convention 1972"); the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal; Global Programme of Action for the Protection of the Marine Environment from Land-based Activities, 1995; and Long Range Transport of Atmospheric Pollutants. For details, see <http://www.unep.org/>; <http://www.imo.org/>, last accessed 03 May 2013; and Freestone & Hey (1996).

refers to those set under the London Convention/Protocol. It enhances the compatibility and consistency of London Convention/Protocol with UNCLOS, and successful implementation of any of them will contribute to the effectiveness of UNCLOS. In case of potential boundaries, they should be clarified in the interest of harmonised and effective operation of these agreements.

Another characteristic linkage is imbedded in the UNCLOS itself regarding two interrelated goals: environmental protection and conservation of marine living resources. Needless to say, they both have distinctive implications to the effects of sea level rise. The UNCLOS Preamble provides that under the general consensus, parties agreed to establish “a legal order for the seas and oceans which will facilitate ... the conservation of their living resources, and ... protection and preservation of the marine environment”.¹⁵⁵ Based on this consensus, the conservation and protection of marine living resources are the ultimate goal of environment protection.

For this purpose, UNCLOS devotes the whole of Part V to marine resources where parties are allowed by Article 56 to establish an EEZ up to 200 nm from the territorial sea baselines to exercise, *inter alia* “sovereign rights for the purpose of exploring and exploiting, conserving and managing the natural resources, whether living or non-living....”¹⁵⁶ This predominantly refers to the right to exclusively harvest the living resources in the EEZ, and to impose conservation measures for the resources and fishing operations conducted in the EEZ.¹⁵⁷ While Article 62 provides that coastal states have certain conservation and restoration obligations towards marine living resources, Article 61 reminds parties to balance their interests between environmental protection and economic development.¹⁵⁸ By so doing, the UNCLOS tries to strive for a balance between the sovereign right of States to exploit their natural resources and their obligations to protect and preserve the marine environment in their EEZs.¹⁵⁹ This is echoed in Part XII by requiring states to take measures to protect and preserve “rare or fragile

155 UNCLOS, Preamble, Para. 5.

156 UNCLOS, Article 56(1a).

157 UNCLOS, Articles 56(1a), 61, and 62.

158 The two relevant environmental and economic factors listed in order are the “economic needs of coastal fishing communities and the special requirements of developing States” and “the interdependence of stocks and any generally recommended international minimum standards.” UNCLOS, Article 61.

159 See also UNCLOS Articles 193, 192.

ecosystems” and “the habitat of depleted, threatened or endangered species and other forms of marine life.”¹⁶⁰ Based on this regime setting, the projected increases in seawater temperature with many adverse impacts oceanic system give rise to claims under the UNCLOS.

III. Compulsory Dispute Settlement and Climate Litigation

As a multilateral instrument of near global adherence concerned with, inter alia, the prevention, reduction and control of marine pollution, the UNCLOS establishes its own adjudicatory system to provide for binding resolution of conflicts that arise under its provisions.¹⁶¹ In cases where disputes related to the interpretation or application of provision arise and cannot be settled through an exchange of views or conciliation, Part XV provides compulsory adjudication procedures that entail binding decisions for such disputes.¹⁶²

Through Annex VI, UNCLOS designated an International Tribunal for the Law of the Sea (ITLOS) to act as its judicial guardian.¹⁶³ In addition to the ITLOS, UNCLOS provides channels for special international arbitral panels for disputes falling into several specialised categories covering fisheries, marine scientific research, protection and preservation of the marine environment, and navigation-related pollution from vessels and by dumping.¹⁶⁴ States may choose to declare their choice of forum when ratifying/acceding to the UNCLOS, but in cases where they have not, or parties to a dispute have not accepted the same procedure for dispute settlement, the dispute may only be submitted to binding arbitration unless the parties agree otherwise.¹⁶⁵

As maintaining linkages to other global treaties on pollution control, UNCLOS also reserves the availability of other international judicial institutions

160 UNCLOS, Article 194(5).

161 Legal scholars proposed various forums for initiating a lawsuit against the United States, including UNCLOS’s compulsory dispute resolution mechanisms. Strauss (2003:8).

162 UNCLOS, Articles 279–285.

163 The Tribunal commenced its work in Hamburg in 1996 and is composed of 21 judges representing the legal systems of the Convention’s Parties (Articles 1, 2, and 4).

164 UNCLOS Annex VIII, Article 1.

165 UNCLOS Article 287(3–5).

responsible for safeguarding the compliance of international laws.¹⁶⁶ The parties to UNCLOS are free to choose whether to submit disputes concerning the interpretation and application of UNCLOS to ITLOS, or whether to apply to an arbitral panel, such as the International Court of Justice (ICJ) in The Hague or another arbitral tribunal.¹⁶⁷

With the compulsory dispute settlement mechanism, chances for UNCLOS parties to take actions against the GHG emitting states for their losses greatly increased. Moreover, one of its implementation agreements, the UN Straddling Fish Stocks Agreement¹⁶⁸ signifying an important development of UNCLOS regime relating to conservation of living resources, can also serve as a dispute resolution mechanism and a means to liability. This agreement is not explicitly intended to deal with the problem of global warming; it does, however, incorporate the system of UNCLOS binding dispute resolution, and provides a framework for protecting certain species of fish, and to the extent that GHG emissions can be shown to endanger such fish, its protective environmental provisions could potentially be liberally interpreted to cover global warming.

Such a mechanism may also be capable of fixing some loopholes of UNFCCC provisions. For example, the non-mandatory language is typical in calling on Annex I Parties¹⁶⁹ to reduce their GHG emissions back to 1990 levels by 2000;¹⁷⁰ the scope of the obligations of the parties to the UNFCCC cannot be established and connected directly to Articles 197, 212, and 235 of UNCLOS. Nonetheless, interpretation of the nature of this obligation must be

166 For a list of cases ITLOS processed, see <http://www.itlos.org/index.php?id=35&L=1AND1%3D1>, last accessed 03 May 2013. For discussions on this account, see Schwarte (2004:423f.).

167 UNCLOS, Article 287(1).

168 The full name is: the United Nations Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks. It was adopted on 4 August 1995 and entered into force on 11 December 2001. As of 7 November 2012, it had 80 ratifications. For further information on this agreement, see, http://www.un.org/Depts/los/convention_agreements/convention_overview_fish_stocks.htm, last accessed 03 May 2013.

169 Under the UNFCCC, Annex I Parties “include the industrialized countries that were members of the OECD (Organization for Economic Co-operation and Development) in 1992, plus countries with economies in transition, see UNFCCC, “Parties and Observers”, see http://unfccc.int/parties_and_observers/items/2704.php last accessed 03 May 2013.

170 UNFCCC, Article 4(2)(a)(b).

read in light of Article 27 of the Vienna Convention on the Law of Treaties, which requires that treaty obligations must be performed in “good faith.”¹⁷¹ Under this accepted principle of customary international law, unless an Annex I Party to the UNFCCC could demonstrate its efforts in taking substantive measures to reduce its emissions back to 1990 levels within the prescribed time period, it would have to face the accountability that it had failed to make a good faith effort to meet the longer-term objectives of the UNFCCC.

Articles 2 and 4(2) of UNFCCC require Annex I Parties to adopt policies and measures to stabilise GHG concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. This would be relevant to an action under UNCLOS given the potential impacts of climate change on ecosystems, fisheries, and the economic development of vulnerable developing states. A party to UNCLOS could argue that all parties which have not met their obligations under the provisions of the UNFCCC are liable for damages under Articles 235 and 197 of UNCLOS.¹⁷² It should also be possible to make a similar argument under the Kyoto Protocol should some of the Protocol’s Parties fail to meet their obligations. Should foreseeable reality be the standard applied to resolve a climate change action under UNCLOS, parties would probably have no problem establishing that both the language of the UNFCCC and the comprehensive assessment reports of the IPCC have put all states on notice in terms of climate threats, and more specifically, potential impacts on marine environments. These states have failed to comply with Article 213 in regard to internationally accepted standards on carbon emissions, and other universally accepted environmental standards such as the no harm rule as the basis of climate change lawsuits.¹⁷³

With these accompaniments, UNCLOS is competent to form a basis for a cause of action for rising sea levels and changes in ocean acidity, and more importantly to protect affected states. However, the application of this mechanism and relevant legal principles would certainly involve various complex

171 Vienna Convention on the Law of Treaties is in force since 27 January 1980 and has 108 parties (as of 15 December 2008). The Convention has been ratified by all major greenhouse gas emitting nations with the exception of the United States. For more information, see <http://untreaty.un.org/cod/avl/ha/vclt/vclt.html>, last accessed 03 May 2013.

172 All industrialised countries are Parties to the UNFCCC. See *supra*, note 5.

173 Osofsky (2005).

legal and scientific questions pertaining to climate change, for example, the attribution of damages, causation, the standard of proof, striking a balance between sovereign rights to exploit natural resources and protecting the marine environment, possible justifications or whether states can be held jointly and severally liable. The low lying states such as SIDS which suffer from sea level rise causing adverse impacts could bring a lawsuit as claimants, as long as a state is an UNCLOS party and can demonstrate that it has suffered detrimental effects from climate change, and it qualifies as a potential litigant in compulsory dispute resolution tribunals of the UNCLOS.¹⁷⁴ Scores of such states are positioned to initiate climate change lawsuits against the major emitters such as the United States if it accedes to the UNCLOS.

F. Concluding Remarks

Climate change is already having wide-spreading impacts on the world's oceanic systems and biodiversity. Sea level rise has brought about significant challenges to coastal states' rights to their maritime zones and access to their vital resources. Global warming and rises in sea level induced by global warming have detrimental effects on those low lying states and pose serious threats to human welfare and sustainability. Climate change is projected to become a progressively more significant threat in the coming decades. Against this background, this article serves as a starting point for further consideration of important issues raised by climate change and issues relating to legal response to its devastating scenario. With a strong focus on remedies, it may be helpful in developing comprehensive research of the wider implications for issues of international legal liability and a better protected and adaptive society against climate change.

The way in which states handle the oceans will be a decisive test of humankind's ability to steer a sustainable course in the future. The failure of the world's major GHG emitting nations to seriously address climate change has made litigation unavoidable.¹⁷⁵ In seeking for possible responses to the climate damages from the law of the sea perspectives, the article provides

174 The Alliance of Small Island States, an intergovernmental body established in 1990 to address global warming and negotiate within the UN system, has 40 members, 38 of which are UNCLOS states parties. For a list of the members, see <http://aois.org/members/>, last accessed 03 May 2013.

175 Burns (2006).

key connections and linkages between the UNCLOS regime on marine environmental protection and other international rules and standards in the form of treaties, from pollution definition to GHG emission inclusion, from UNCLOS compulsory dispute settlement to UNFCCC, Kyoto Protocol implementation and emission control. The article demonstrated the justification of GHG as one of many marine pollution sources and its catastrophic consequences to oceanic systems before going on to scrutinise existing international mechanisms as responses and remedies for such disastrous consequences.

UNCLOS creates an extensive framework for taking and enforcing measures against different sources of marine pollution and strongly clarifies state responsibilities for breaching its duties. UNCLOS can serve as an important mechanism and strategy to combat climate change. Although, as with most international treaties, it lacks the executive power of enforcement, UNCLOS may prove to be a primary battle-ground under mounting pressures from climate change, species extinction, overfishing and maritime pollution. Given its broad definition of pollution to the marine environment and the dispute resolution mechanisms, UNCLOS has a remarkable ability to adapt to changing circumstances and great potential to provide means for affected states such as SIDS to seek for remedies for climate damages. As a promising instrument, UNCLOS will continue to develop its normative effect in the ocean domain and play a key role as a mechanism to confront climate change.

References

- Andersson, Jessica, 2007, The Recreational Cost of Coral Bleaching. A Stated and Revealed Preference Study of International Tourists, *Ecological Economics* 62, 704–715.
- Attenhofer, Jonas, 2010, Baselines and Base Points: How the Case Law Withstands Rising Sea Levels and Melting Ice, *Law of the Sea Reports* 1, 2010, Law of the Sea Interest Group, American Society of International Law, available at <http://www.asil.org/losr/ports/LOSReportsVol12010w3Attenhofer.pdf>, last accessed 30 April 2013.
- Bach, Tracy & Justin Brown, 2009, Recent Developments in Australian Climate Change Litigation: Forward Momentum from Down Under, *Vermont Law School Legal Studies Research Paper Series* 10-12, 38–44.
- Basse, Ellen Margrethe, 2001, Environmental Liability – Modern Developments, in: Wahlgren, Peter (Ed.), *Tort Liability and Insurance*, Stockholm, Stockholm Institute for Scandinavian Law, 31–53.
- Brownlie, Ian, 1983, *System of the Law of Nations – State Responsibility* (Part I), Oxford, Oxford University Press.

- Burns, William C.G., 2001, The Possible Impacts of Climate Change on Pacific Island State Ecosystems, *International Journal of Global Environmental Issues* 1, 56–72.
- Burns, William C.G., 2003, Pacific Island Developing Country Water Resources and Climate Change, in: Gleick, Peter H. (Ed.), *The World's Water 2002-2003: The Biennial Report on Freshwater Resources*, Washington D.C., Island Press, 113–132.
- Burns, William C.G., 2006, Potential Causes of Action for Climate Change Damages in International Fora: The Law of the Sea Convention, *International Journal of Sustainable Development Law & Policy* 2 (1), 27–51.
- Caron, David D., 1990, When Law Makes Climate Change Worse: Rethinking the Law of Baselines in Light of a Rising Sea Level, *Ecology Law Quarterly* 17, 621–653.
- Caron, David D., 2008, Climate Change, Sea Level Rise and the Coming Uncertainty in Oceanic Boundaries: A Proposal to Avoid Conflict, in: Hong, Seoung-Yong & Jon Van Dyke (Eds), *Maritime Boundary Disputes, Settlement Processes, and the Law of the Sea*, Volume 65 of Publications on Ocean Development Series, Leiden, BRILL, 1–18.
- Charney, Jonathan I., 1977, Law of the Sea: Breaking the Deadlock, *Foreign Affairs* 55, 598–629.
- Churchill, Robin, 2008–, Coastal Fisheries, in: Wolfrum, Rüdiger (Ed.), *Max Planck Encyclopedia of Public International Law*, Oxford, Oxford University Press, online edition available at <http://www.mpepil.com>, last accessed 30 April 2013.
- Churchill, Robin & David Freestone (Eds), 1991, *International Law and Climate Change*, London/Dordrecht, Graham & Trotman/Martinus Nijhoff.
- Churchill, Robin & Alan Lowe, 1999, *The Law of the Sea* (Third Edition), Manchester, Manchester University Press.
- Conservation International, 2008, *Economic Values of Coral Reefs, Mangroves, and Seagrasses: A Global Compilation*, Arlington, VA, Center for Applied Biodiversity Science, Conservation International, available at http://www.conservation.org/documents/CI_Marine_CI_Economic_Values_Coral_Reefs_Mangroves_Seagrasses_compilation_2008.pdf, last accessed 02 May 2013.
- Costanza, Robert, Ralph d'Arge, Rudolf de Groot, Stephen Farberk, Monica Grasso, Bruce Hannon, Karin Limburg, Shahid Naeem, Robert V. O'Neill, Jose Paruelo, Robert G. Raskin, Paul Suttonkk & Marjan van den Belt, 1997, The Value of the World's Ecosystem Services and Natural Capital, *Nature* 387, 253–260.
- Crutzen, Paul J., & Eugene F. Stoermer, 2000, The “Anthropocene”, *Global Change Newsletter* 41, 12–13.
- Dang, Hanh H., Axel Michaelowa, & Dao D. Tuan, 2003, Synergy of Adaptation and Mitigation Strategies in the Context of Sustainable Development: The Case of Vietnam, *Climate Policy* 3 Supplement 1, S81–S96.
- Dernbach, John C. & Seema Kakade, 2008, Climate Change Law: An Introduction, *Energy Law Journal* 29 (1), 1–31.
- Diaz, Robert J. & Rutger Rosenberg, 2008, Spreading Dead Zones and Consequences for Marine Ecosystems, *Science* 321, 926–929.

- Dipla, Hartini, 2008–, Islands, in: Wolfrum, Rüdiger (Ed.), *Max Planck Encyclopedia of Public International Law*, Oxford, Oxford University Press, online edition available at <http://www.mpepil.com>, last accessed 30 April 2013.
- Doney, Scott C., Mary Ruckelshaus, J. Emmett Duffy, James P. Barry, Francis Chan, Chad A. English, Heather M. Galindo, Jacqueline M. Grebmeier, Anne B. Hollowed, Nancy Knowlton, Jeffrey Polovina, Nancy N. Rabalais, William J. Sydeman & Lynne D. Talley, 2012, Climate Change Impacts on Marine Ecosystems, *Annual Review of Marine Science* 4, 11–37.
- Dore, Mohammed H.I., 2005, Climate Change and Changes in Global Precipitation Patterns: What Do We Know? *Environment International* 31, 1167–1181.
- Elliott, Lorraine & Mely Caballero-Anthony (Eds), 2012, *Human Security and Climate Change in Southeast Asia: Managing Risk and Resilience*, London, Routledge.
- FAO/Food and Agricultural Organisation, 2011, *The State of World Fisheries and Aquaculture*, Rome, FAO, Fisheries and Aquaculture Department.
- Freestone, David & Ellen Hey, 1996, *The Precautionary Principle and International Law – The Challenge of Implementation*, The Hague, Kluwer Law International.
- Freestone, David & John Rethick, 1994, Sea Level Rise and Maritime Boundaries: International Implications for Impacts and Responses, Maritime Boundaries, in: Blake, Gerald H. (Ed.), *Maritime Boundaries: World Boundaries* (Volume 5), London, Routledge, 73–88.
- Freestone, David & Rosemary Rayfuse, 2008, Iron Ocean Fertilization and International Law, *University of New South Wales, Faculty of Law Research Series* 37, 1–12.
- Ghina, Fathimath, 2003a, *Sustainable Development in Small Island Developing States*, Dordrecht, Dordrecht, Kluwer Academic Publishers.
- Ghina, Fathimath, 2003b, Sustainable Development In Small Island Developing States – The Case of the Maldives, *Environment, Development, and Sustainability* 5, 139–165.
- Gilman, Eric, Hanneke Van Lavieren, Joanna Ellison, Vainuupo Jungblut, Lisette Wilson, Francis Areki, Genevieve Brighthouse, John Bungitak, Eunice Dus, Marion Henry, Mandes Kilman, Elizabeth Matthews, Ierupaala Sauni Jr., Nenenteiti Teariki-Ruatu, Sione Tugia & Kathy Yuknavage, 2006, *Pacific Island Mangroves in a Changing Climate and Rising Sea*, UNEP Regional Seas Reports and Studies No.179, Nairobi: UNEP, Regional Seas Programme, available at <http://www.unep.org/PDF/mangrove-report.pdf>, last accessed 30 April 2013.
- Global Carbon Capture Storage (CCS) Institute, 2012, *The Global Status of CCS: 2012*, Canberra, Global CCS Institute, available at <http://cdn.globalccsinstitute.com/sites/default/files/publications/47936/global-status-ccs-2012.pdf>, last accessed 03 May 2013.
- Hafetz, Jonathan L., 2000, Fostering Protection of the Marine Environment and Economic Development: Article 121(3) of the Third Law of the Sea Convention, *American University International Law Review* 15 (3), 583–596.
- Hinrichsen, Don, 1998, *Coastal Waters of the World: Trends, Threats, and Strategies*, Washington D.C., Island Press.

- Hoegh-Guldberg, Ove, 2011, NCSE Talk on Climate Change Impacts on Ocean Ecosystems, *Climate Shifts*, 21 January 2011, available at <http://www.climateshifts.org/?p=6221>, last accessed 30 April 2013.
- Hofmann, Gretchen, James P. Barry, Peter J. Edmunds, Ruth D. Gates, David A. Hutchins, Terrie Klinger & Mary A. Sewell, 2010, Ocean Acidification Impacts on Calcifying Marine Organisms in Marine Ecosystems, *Annual Review Ecology Evolution System* 41, 127–147, available at [http://www.mbari.org/staff/barry/papers_\(pdf\)/Hofmann%20et%20al.%202010%20-%20OA%20on%20calcifying%20organism.s.pdf](http://www.mbari.org/staff/barry/papers_(pdf)/Hofmann%20et%20al.%202010%20-%20OA%20on%20calcifying%20organism.s.pdf), last accessed 30 April 2013.
- Hughes Terry P., Hui Huang & Mathew A.L. Young, The Wicked Problem of China's Disappearing Coral Reefs, *Conservation Biology* 27 (2), 261–269, available at <http://onlinelibrary.wiley.com/doi/10.1111/j.1523-1739.2012.01957.x/pdf>, last accessed 03 May 2013.
- Ingelson, Allan, Anne Kleffner, & Norma Nielson, 2010, Long-term Liability for Carbon Capture and Storage in Depleted North American Oil and Gas Reservoirs – a Comparative Analysis, *Energy Law Journal* 31, 431–469.
- IPCC/Intergovernmental Panel on Climate Change, 2005, *IPCC Special Report on Carbon Dioxide Capture and Storage*. Prepared by Working Group III of the Intergovernmental Panel on Climate Change, Metz, Bert, Ogunlade R. Davidson, Heleen C. de Coninck, Manuela Loos & Leo A. Meyer (Eds), Cambridge, Cambridge University Press, available at http://www.ipcc.ch/pdf/special-reports/srccs/srccs_wholereport.pdf, last accessed 03 May 2013.
- IPCC/Intergovernmental Panel on Climate Change, 2007a, *Climate Change 2007: Synthesis Report*. Contribution of Working Groups I, II and III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, Core Writing Team: Pachauri, Rajendra K. & Andy Reisinger (Eds), Geneva, IPCC, available at http://www.ipcc.ch/publications_and_data/publications_ipcc_fourth_assessment_report_synthesis_report.htm, last accessed 13 January 2013.
- IPCC/Intergovernmental Panel on Climate Change, 2007b, Summary for Policymakers, in: Susan Solomon, Dahe Qin, Martin Manning, Zhenlin Chen, Melinda Marquis, Kristen B. Averyt, Melinda Tignor & Henry L. Miller (Eds), *Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*, Cambridge, Cambridge University Press, 1-18.
- IPCC/Intergovernmental Panel on Climate Change, 2007c, *Climate Change 2007: Mitigation of Climate Change. Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*, Bert Metz, Ogunlade R. Davidson, Peter R. Bosch, Rutu & Leo A. Meyer (Eds), Cambridge, Cambridge University Press.
- IPCC/Intergovernmental Panel on Climate Change, 2007d, *Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*, Parry, Martin L., Osvaldo F. Canziani, Jean Palutikof, Paul J. Van der Linden & Clair E. Hanson (Eds), Cambridge, Cambridge University Press.

- IPCC/Intergovernmental Panel on Climate Change, 2007e, *Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*, Solomon, Susan, Dahe Qin, Martin Manning, Zhenlin Chen, Melinda Marquis, Kristen B. Averyt, Melinda Tignor & Henry L. Miller (Eds), Cambridge, Cambridge University Press.
- Kelman, Ilan, 2011, Dealing with Climate Change on Small Island Developing States, *Practicing Anthropology*, 2011, 28–32.
- Kelman, Ilan, & Jennifer J. West, 2009, Climate Change and Small Island Developing States: A Critical Review, *Ecological and Environmental Anthropology* 5 (1), 1–16, available at <https://eea.anthro.uga.edu/index.php/eea/article/view/69/55>, last accessed 02 May 2013.
- Kim, Ja-Young, 2010, International Marine Affairs & Territory Research Department, KMI, Special Edition, *Dokdo Research Journal* 11, 101–105.
- Koh, Tommy T.B., 1982, A Constitution for the Oceans, United Nations, Division for Ocean Affairs and the Law of the Sea, available at http://www.un.org/Depts/los/convention_agreements/texts/koh_english.pdf, last accessed 02 May 2013.
- Kwiatkowska, Barbara, 2007, The 2006 Barbados/Trinidad and Tobago Maritime Delimitation (Jurisdiction and Merits) Award, in: Tafsir Malick Ndiaye & Rüdiger Wolfrum (Eds), *Law of the Sea, Environmental Law and Settlement of Disputes: Liber Amicorum Judge Thomas A. Mensah*, Leiden/Boston, Martinus Nijhoff Publishers, 917–944.
- Lewis, James, 1990, The Vulnerability of Small Island States to Sea Level Rise: The Need for Holistic Strategies. *Disasters* 14 (3), 241–248.
- Lewis, James, 1999, *Development in Disaster-prone Places: Studies of Vulnerability*, London, Intermediate Technology Publications.
- Lewsey, Clement & Edward Kruse, 2004, Assessing Climate Change Impacts on Coastal Infrastructure in the Eastern Caribbean, *Marine Policy* 28, 393–409.
- Lubchenco, Jane, 2008, Climate Change has Major Impact on Oceans, *EurekAlert* 17 February 2008, available at http://www.eurekalert.org/pub_releases/2008-02/osu-cc-h021308.php#, last accessed 02 May 2013.
- McAdam, Jane, 2009, Environmental Migration Governance, *University of New South Wales, Faculty of Law Research Series* (6), 1–33.
- Myles, Allen, 2003, Liability for Climate Change, *Nature* 421, 891–892.
- Nolon, John R., 2012, Managing Climate Change through Biological Sequestration: Open Space Law Redux, *Stanford Environmental Law Journal* 31, 195–249.
- Nordquest, Myron, Satya N. Nandan, & Shabtai Rosenne, 1991, *United Nations Convention on the Law of the Sea 1982: A Commentary*, Volume IV, Dordrecht, Martinus Nijhoff Publishers.
- Osofsky, Hari M., 2005, The Geography of Climate Change Litigation: Implications for Transnational Regulatory Governance, *Washington University Law Quarterly* 83, 1789–1855, available at <http://digitalcommons.law.wustl.edu/lawreview/vol83/iss6/3>, last accessed 02 May 2013.

- Painting, Rob, 2011, Coral: Life's a Bleach... and Then You Die, *Skeptical Science*, 13 January 2011, available at <http://www.skepticalscience.com/Coral-lifes-a-bleach-and-then-you-die.html>, last accessed 02 May 2013.
- Park, Susin, 2011, Climate Change and the Risk of Statelessness: The Situation of Low-lying Island States, UNHCR Legal and Protection Policy Research Series, available at <http://www.unhcr.org/protect>, last accessed 02 May 2013.
- Peel, Jacqueline, 2007, The Role of Climate Change Litigation in Australia's Response to Global Warming, *Environmental and Planning Law Journal* 24, 90–105.
- Pernetta, John C., 1992, Impacts of Climate Change and Sea-Level Rise on Small Island States, *Global Environmental Change* 2, 19–31.
- Purdy, Ray, 2006, The Legal Implications of Carbon Capture and Storage under the Sea, *Sustainable Development Law and Policy* 7, 22–25.
- Rayfuse, Rosemary, 2008, Drowning Our Sorrows to Create a Carbon Free Future? Some International Legal Considerations Relating to Sequestering Carbon by Fertilising the Oceans, *University of New South Wales Law Journal* 31 (3), 919–930, available at http://works.bepress.com/rosemary_rayfuse/10, last accessed 02 May 2013.
- Rayfuse, Rosemary, 2010, International Law and Disappearing States: Utilising Maritime Entitlements to Overcome the Statehood Dilemma, *University of New South Wales, Faculty of Law Research Series*, Paper 52, 1–13.
- Roach, J. Ashley & Robert W. Smith, 1994, *Excessive Maritime Claims*, International Studies Volume 66, Newport, Naval War College.
- Schwarte, Christoph, 2004, Environmental Concerns in the Adjudication of the International Tribunal for the Law of the Sea, *Georgetown International Environmental Law Review* 16, 421–430.
- Schwarte, Christoph, 2012, 'No-harm rule' and Climate Change, Briefing Paper Legal Response Initiative, 24 July 2012, available at [http://www.legalresponseinitiative.org/download/BP42E%20-%20Briefing%20Paper%20-%20No%20Harm%20Rule%20and%20Climate%20Change%20\(24%20July%202012\).pdf](http://www.legalresponseinitiative.org/download/BP42E%20-%20Briefing%20Paper%20-%20No%20Harm%20Rule%20and%20Climate%20Change%20(24%20July%202012).pdf), last accessed 02 May 2013.
- Scovazzi, Tullio, 2008–, Baselines, in: Wolfrum, Rüdiger (Ed.), *Max Planck Encyclopedia of Public International Law*, Oxford, Oxford University Press, online edition available at <http://www.mpepil.com>, last accessed 30 April 2013.
- Secretariat of the Convention on Biological Diversity, 2010, *Global Biodiversity Outlook 3*, Montreal, Secretariat of the Convention on Biological Diversity, available at <http://www.cbd.int/doc/publications/gbo/gbo3-final-en.pdf>, last accessed 02 May 2013.
- Shah, Anup, 2012, Climate Change Affects Biodiversity, *Global Issues*, 04 March 2012, available at <http://www.globalissues.org/article/172/climate-change-affects-biodiversity>, last accessed 02 May 2013.
- Society of Conservation Biology, Conservation Biology, 2012, 1-9, available at <http://onlinelibrary.wiley.com/doi/10.1111/j.1523-1739.2012.01957.x/pdf>.
- Soons, Alfred H.A., 1990, The Effects of a Rising Sea Level on Maritime Limits and Boundaries, *Netherlands International Law Review* 37 (2), 207–232.

- Staudinger, Michelle D., Nancy B. Grimm, Amanda Staudt, Shawn L. Carter, F. Stuart Chapin III, Peter Kareiva, Mary Ruckelshaus & Bruce A. Stein, 2012, *Impacts of Climate Change on Biodiversity, Ecosystems, and Ecosystem Services: Technical Input to the 2013 National Climate Assessment. Cooperative Report to the 2013 National Climate Assessment*, available at <http://downloads.usgcrp.gov/NCA/Activities/Biodiversity-Ecosystems-and-Ecosystem-Services-Technical-Input.pdf>, last accessed 02 May 2013.
- Strauss, Andrew L., 2003, The Legal Option: Suing the United States in International Forums for Global Warming Emissions, *Environmental Law Reporter* 33, 1–12.
- Tol, S.J. Richard & Roda Verheyen, 2004, State Responsibility and Compensation for Climate Change Damages – A Legal and Economic Assessment, *Energy Policy* 32, 1109–1130.
- United Nations Economic and Social Council, 2011, *Integrated Analysis of United Nations System Support to Small Island Developing States*, Report of the Secretary-General, Geneva, Economic and Social Council, available at http://www.un.org/ga/search/view_doc.asp?symbol=E%2F2011%2F110&Lang=E&utm_source=feedburner&utm_medium=email&utm_campaign=Feed%3A+LatestUnDocuments-EconomicSocialCouncilDocuments+%28Latest+UN+documents+-+Economic+%26+Social+Council+documents%29, last accessed 30 April 2013.
- United Nations General Assembly, 1994, *Report of the Global Conference on the Sustainable Development of Small Island Developing States*, A/CONF.167/9, Barbados, 1994, available at <http://www.un.org/documents/ga/conf167/aconf167-9.htm>, last accessed 30 April 2013.
- United Nations Office for Oceans Affairs and the Law of the Sea, 1989, *The Law of the Sea: Baselines: An Examination of the Relevant Provisions of the United Nations Convention on the Law of the Sea*, New York, United Nations Office for Oceans Affairs and the Law of the Sea.
- Vaughan, David G. & John R. Spouge, 2002, Risk Estimation of Collapse of the West Antarctic Ice Sheet, *Climatic Change* 52, 65–91.
- Vicuña, F. Orrego, 1998, Responsibility and Liability for Environmental Damage under International Law: Issues and Trends, *Georgetown International Environmental Law Review* 10, 279ff.
- Voccia, Alexander, 2012, Climate Change: What Future for Small, Vulnerable States? *International Journal of Sustainable Development and World Ecology* 19 (2), 101–115.
- WBGU//Wissenschaftlicher Beirat der Bundesregierung Globale Umweltveränderungen, German Advisory Council on Global Change, 2006, *The Future Oceans – Warming Up, Rising High, Turning Sour*, Berlin, WBGU, available at http://cmbc.ucsd.edu/Research/Climate_Change/Future%20Oceans.pdf, last accessed 02 May 2013.
- Weinbaum, Aura, 2011, Unjust Enrichment: An Alternative to Tort Law and Human Rights in the Climate Change Context? *Pacific Rim Law & Policy Journal* 20 (2), 412–429.
- Wiggins, Lucy, 2007, Existing Legal Mechanisms to Address Oceanic Impacts from Climate Change, *Sustainable Development Law & Policy*, 22–24, 78–79.

- Wilson, Edward O., Lecture delivered at Convention on Biological Diversity, Conference of Parties, Nagoya, Japan, quoted by Secretariat of the Pacific Regional Environment Programme, Press Release – Save the Pacific, 25 October 2010, available at: http://www.sprep.org/Art./news_print.asp?id=842, last accessed 13 August 2012.
- Wisner, Ben, Piers Blaikie, Terry Cannon, & Ian Davis, 2004, *At Risk: Natural Hazards, People's Vulnerability and Disasters* (Second Edition), London, Routledge.
- Wood, Mary, 2010, “You Can’t Negotiate with a Beetle”: Environmental Law for a New Ecological Age, *Natural Resources Journal* 50, 167–210.
- WWF/World Wide Fund for Nature, 2009, *WWF Species Status Report: Marine Fisheries in the Wild*, Switzerland, WWF.
- Xue, Guifang (Julia), 2011, How Much Can a Rock Get? – A Reflection from the Okinotorishima Rocks, *China Oceans Law Review* 13, 3–23.
- Yamin, Farhana, & Joanna Depledge, 2004, *The International Climate Change Regime – A Guide to Rules, Institutions and Procedures*, Cambridge, Cambridge University Press.
- Zimmer, Carl, 2011, Multitude of Species Face Climate Threat, *N.Y. Times*, 04 April 2011.

