Chapter I

Climate Change, Sea Level Rise and the Coming Uncertainty in Oceanic Boundaries: A Proposal to Avoid Conflict

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I. *Introduction*

Even as it is widely acknowledged that climate change will alter the world over the coming century, it is unclear how different regions of the globe will be affected by this change. How much dryer or wetter will France be, and how much more disease will be induced by the changes in Central America, are but two examples. Amidst this uncertainty, however, two impacts are known quite clearly. First, the melting of the great ice sheets and glaciers will continue, and perhaps, melt even faster. Second, the oceans will rise over the next century on the order of .5 to one meter (1.5 to three feet). This rise in sea level will be felt around the world.

This Chapter focuses on how a rising sea level will create uncertainties as to the outer boundaries of the zones of valuable ocean territory and rights possessed by coastal states. Uncertainty in boundaries is undesirable and, in this instance, may foster conflicting claims to valuable ocean resources. The likelihood of such conflict may be particularly high given that this uncertainty in boundaries will arise as adaptation to climate change simultaneously stretches the resources of each state.

The Chapter examines this potential for conflict, the reasons that boundaries will become uncertain, and suggests avenues, both normative and institutional, whereby this uncertainty and conflict may be avoided or mitigated. There are three parts to this story.

Part II highlights those areas of the oceans that belong, to some extent, to adjacent coastal states and, in particular, concentrates on the practice of using the

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"law of baselines" to ascertain the outer boundary of such oceanic zones. The "law of baselines" is a set of detailed rules that, broadly speaking, seek to give content to give content to the principle that baselines should follow the general direction of the coastline. Part III briefly reviews the present projections concerning a rising sea level as a consequence of climate change.

Part IV brings these two points together and considers the implications of sea level rise for baselines and thus the ocean boundaries ascertained by reference to such baselines. Four key points emerge:

(1) in many cases, the law of baselines allows such lines to be based on geographic features barely above sea level;
(2) therefore, almost any change in sea level may have very dramatic effects on certain baselines;
(3) these effects on baselines may have a potentially dramatic effect on boundaries because the baselines and boundaries generated from them are "ambulatory" (that is, the baselines – and therefore the boundaries – adjust themselves to a changing coastline); and
(4) the rise in sea level in particular geographic situations will result in significant shifts in the outer boundaries of the oceanic zones claimed by coastal states.

Elsewhere, I have described such aspects of our laws as "legal" feedbacks to climate change.[1] A legal feedback, unlike a physical feedback, does not accelerate or mitigate the underlying process of climate change itself. Rather, it accelerates or mitigates the damage that will be felt as a consequence of any level of climate change. Moreover, a legal feedback, unlike a physical one, is not fixed in the laws of nature, but rather, can be changed.

In the case of a rising sea level, the law of baselines gives rise to a legal feedback that increases the potential for the waste of resources as well as private and interstate conflict. This Chapter focuses on the potential for conflict. States and individuals amidst an ever increasing competition for resources in, or under, the oceans will be tempted to take advantage of the uncertainty in maritime boundaries that will result from a rising sea level and the movement of baselines. The Chapter closes with proposals and strategies for addressing the present legal feedback, the ambulatory nature of baselines and the boundaries they generate, which is at the root of the uncertainty and potential for conflict.

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[1] In the science of climate change, a feedback is a physical process triggered by climate change that may either exacerbate or mitigate the underlying process of climate change. For example, melting of the tundra in the far North as a result of warming may lead to the release of significant amounts of methane which in turn may accelerate the process of warming. *See* When Law Makes Climate Change Worse, *supra* note *.

II. *The Curious History of Baselines*

Under international law, coastal states may claim in the ocean adjacent to them up to a 12-mile territorial sea, a 24-mile contiguous zone, a 200-mile exclusive economic zone (EEZ) and, in some circumstances, a continental shelf out to 350 miles. Today, the same baseline serves as the line from which the outer boundaries of all these zones are measured.[2]

For a newcomer to oceanic boundaries, it can be surprising that the rules concerning the construction of baselines developed substantially after states first claimed a territorial sea (sometimes then referred to as marginal seas). The reason for the time lag is that the early claims to a territorial sea were of an indefinite, rather than fixed, width. For example, an early method of determining the width of the territorial sea was by reference to the "cannon shot" rule. Putting aside the fact that the range of cannons varied tremendously and certainly increased over time, the important aspect to note is that the cannon shot rule, as a means for determining the width of the territorial sea, carried within itself the outer boundary, and thus, there was no need to determine a baseline point. The question of the baselines lay arose only when states began to assert a fixed width. It is often stated that the first

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[2] The four present major ocean zones are most clearly discussed in the widely adopted Convention on the Law of the Sea, *opened for signature* Dec. 10 1982, U.N. Doc. A/Conf. 62/122 (1982), *reprinted in* 21 I.L.M. 1261 (1982). All of these zones are to be measured from the baseline from which the territorial sea is measured:

(1) *The territorial sea.* The sovereignty of a coastal state extends to an adjacent belt of sea called the territorial sea. *Id.* art. 2. The territorial sea may not exceed 12-n.m. in breadth, "measured from baselines determined in accordance with this Convention." *Id.* art. 3.

(2) *The contiguous zone*. In a belt of sea contiguous to the territorial sea, the coastal state may exercise the control necessary to prevent or punish infringement of customs, fiscal, immigration, and sanitary laws in its territory or territorial sea. *Id.* art. 33(1). This contiguous zone may not exceed 24-n.m. in breadth "from the baselines from which the breadth of the territorial sea is measured." *Id*. art. 33(2).

(3) *The exclusive economic zone*. The exclusive economic zone is an area beyond and adjacent to the territorial sea in which the coastal state possesses certain rights and jurisdiction and all other states possess certain rights and freedoms. *Id*. art. 55. As a general matter, the coastal state possesses sovereign rights over the natural resources, whether living or nonliving, of the waters and seabed in the zone, *id.* art. 56(1), while all other states possess the freedoms of navigation and overflight. *Id.* art. 58. The breadth of the exclusive economic zone shall not exceed 200-n.m. "from the baselines from which the breadth of the territorial sea is measured." *Id.* art. 57.

(4) *The continental shelf*. The coastal state possesses sovereign rights over the continental shelf adjacent to it beyond those rights already recognized in the exclusive economic zone to the degree the shelf extends beyond the outer limit of that exclusive economic zone. *Id.* art. 77. The outer edge of the continental shelf is determined under a complex physical definition, but in almost all cases "shall not exceed 350-n.m. from the baselines from which the breadth of the territorial sea is measured." *Id.* art. 76(6).

fixed width assertion came with President Jefferson's declaration in 1793, where the new United States of America claimed a territorial sea with the relatively modest fixed width of three-nautical miles (n.m.). It is said this distance was chosen so as to *clearly* indicate the outer boundary of a modest claim thereby possibly avoiding foreign conflict.

Intime, the emergence of a fixed width to territorial sea claims in time gave rise to a natural question: from where was the fixed distance to be measured? State practice emerged in the 1800s regarding the proper selection of baselines, and by the year 1900 it was widely accepted that the basic baseline followed the "low water mark" along the coastline.

Many questions remained, however, given the complexities of coastlines, such as the presence of rocks and islands, mud flats and fringing reefs, not to mention rivers, bays and fiords. Custom came to indicate some of the answers. To address the questions more definitely, a conference was called by the League of Nations in The Hague during the interwar period. The preparations for the conference revealed an interesting, and not altogether surprising, difference of opinion regarding the law of baselines. On the one hand, geographers who studied the functions of boundaries sought to bring their theory to bear on the baseline selection rules. Functionally, in their view, boundaries were meant to visibly demarcate an area and provide guidance to persons at sea as to whether they were or were not within, for example, the territorial sea of the coastal state. From this perspective, the geographers sought to have a system of baseline points sufficiently substantial so that fishers at sea would be able to triangulate their positions visibly. On the other hand, there was what might be called the "expansionist view," which came, as a political matter, quite naturally to the states involved. It gave primacy to the extent of each state's territorial sea into the ocean above the functionality of the baseline system that allowed such extension. Given the interstate character of the 1930 Conference of States in The Hague, the expansionist view, not surprisingly, won the day and is now manifest in the baseline rules.[3]

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[3] A concern for the ascertainability of boundaries by those at sea heavily influenced the position of the United States delegation to the 1930 Hague Codification Conference. *See* Samuel Whittemore Boggs, *Delimitation of the Territorial Sea: The Method of Delimitation Proposed by the Delegation of the United States at the Hague Conference for the Codification of International Law*, 24 Am. J. Int'l L. 541 (1930). Samuel Whittemore Boggs, then Geographer of U.S. Department of State, wrote:

> Since the legal rights of the coastal state and of foreign states within the territorial sea differ greatly from the rights of all states on the high sea, it should be made possible for a navigator, or a fisherman, or the coastal state, to determine with certainty whether or not a vessel is in territorial waters on the high sea.
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> The difficulties hitherto encountered in delimiting portions of the territorial sea have arisen, however, largely from the viewpoint of a man on the land rather than the viewpoint of the navigator.

An example of the prevailing perspective is seen in a rock that emerges and dries in the sun at low tide (a "low tide elevation"). Although most certainly not a functional base point from the perspective of the geographers, expansionists accepted such a rock as a valid basic point because it would possibly extend the territorial sea of the coastal state a little further.[4] The crucial point to recognize is that by this fundamental predisposition, the law of baselines authorizes, quite intentionally, the most insubstantial, sometimes ephemeral and transient, geographic features to serve as anchors for baselines thus maximizing for each coastal state the reach of their oceanic zones into the ocean.

The rules continued to develop and solidify during the 50 years following the 1930 Hague Conference, and came to have specific provisions addressing highly indented coastlines and archipelagoes. In addition, more zones arose both for maritime spaces and for the seabed and subsoil. The baseline rules developed for the territorial sea were then adopted for the delimitation of these new zones, thus gaining in application and importance.

When the law of baselines was first formulated in the 1930s, and even as it was revised and refined through the 1970s, the prospect of a rising seal level was not in the minds of the drafters.[5] As we have seen, the development of the law of baselines almost pathologically listed and adopted quite insubstantial geographic features as valid baseline points. The individuals involved must have been aware that coastlines changed occasionally in specific locations, but they apparently viewed such changes as rare and isolated. The prospect of a global rise in sea level, however, fundamentally challenges this assumption.

The coasts of the world are constantly changing due to particular local circumstances. The land may be rising because the weight of glaciers has been removed. The land may sink because of the depletion of aquifers. And, of course, the land along the coastline may erode. A sustained and global rise in sea level, however, is altogether another matter.

But although concern for how the mariner and fisher were to locate a boundary upon the sea was occasionally present, it generally was overwhelmed by economic or security concerns.

[4] *See, e.g.*, Yoshifumi Tanaka, *Low-Tide Elevations in International Law of the Sea: Selected Issues*, 20 Ocean Y.B. 189–219 (2006).

[5] Jose Luiz Jesus, Judge with the International Tribunal for the Law of Sea, wrote of the negotiation of the 1982 Law of the Sea Convention that "[t]he prospect of sea-level rise and its effect on maritime space and borderlines was not specifically addressed by the 1982 Convention. Indeed, during the Conference this was not a major concern." Jose Luiz Jesus, *Rocks, new-born islands, sea level rise and maritime space*, in Negotiating for Peace – Liber Amicorum Tono Eitel 579, 601 (J.A. Frowein, K. Scharioth, I. Winkelmann and R. Wolfrum, eds, 2003).

III. *But the World Does Change: The Specter of a Rising Sea Level*

Jim Hansen, a leading climate scientist, recently wrote that the "greatest threat of climate change for human beings, I believe, lies in the potential destabilization of the massive ice sheets in Greenland and Antarctica."[6] Knowledge of where many of the impacts of climate change will be felt remains elusive. All agree, however, that a rising sea level will impact all coastal areas.

Predictions concerning the extent of the rise in sea level over the next century tend to focus on two mechanisms: thermal expansion of surface waters (the "steric effect");[7] and the continued breakup and melting of land ice (meaning, the Greenland ice sheet and glaciers).[8] Estimates for at least the next century tend to assume, although not exclusively, that there will not be a sufficient rise in temperature to require consideration of a third potential cause of sea level rise, the significant breakup or melting of the Antarctic ice sheets. The Intergovernmental Panel on Climate Change (IPCC) in its recent 2007 report estimated a range of 0.38 to 0.59-meter rise in the sea level by the year 2100. At the same time, numerous scientists note that the IPCC methodology, for understandable reasons, is conservative in its estimations.[9] An example recognized in the IPCC report itself is that its model

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[6] Jim Hansen, *The Threat to the Planet*, The N.Y. Rev.of Books 12, 13 (July 13, 2006). Dr. Hansen is the Director of the NASA Goddard Institute for Space Studies and an Adjunct Professor of Earth and Environmental Sciences at Columbia.

[7] There has been some confusion over the past few years as to whether the upper ocean layers were cooling rather warming. But studies in 2007, however, suggest that the cooling conclusion reached in a study of a few years ago was a consequence of an instrumentation error. The original team is revisiting its data. *See Seas Are Warming After All*, 194 NewScientist 4, 5 (28 April 2007).

[8] The melting sea ice in the Arctic or elsewhere does not result in a rise in sea level because that ice is already present in the ocean. Its displacement is approximately equivalent. It should be noted that there is some uncertainty about the mechanisms at work in sea level rise. Working Group II of the IPCC in its April 2007 report wrote:

> the global average sea level rise for the last 50 years is likely to be larger than can be explained by thermal expansion and loss of land ice due to increased melting, and thus for this period it is not possible to satisfactorily quantify the known processes causing sea level rise.

Climate Change 2007 – The Physical Science Basis: Summary for Policymakers – Contribution of Working Group I to the Fourth Assessment Report of the IPCC 421 (2007). In this regard, *see also* Laury Miller & Bruce C. Douglas, *Mass and Volume Contributions to Twentieth-Century Global Seal Level Rise*, 428 Nature 406 (25 March 2004). Sea level rise predicted over the next several centuries is distinct from very long term changes anticipated in the size and depth of the oceans basins, *see Sea Levels Are Falling Over the Long term Because of Lower Basins*, N.Y. Times, March 11, 2008 at D3.

[9] Fred Pearce, *But Here Is What They Didn't Tell Us*, NewScientist 7 (10 February 2007). *See also Consensus Is Not Enough*, NewScientist 3 (10 February 2007); Bill McKibben, *Warning on Warming*, The New York Review of Books 44 (March 15, 2007) (reviewing Climate Change 2007 – The Physical Science Basis: Summary for Policymakers – Contribution of Working Group I to the Fourth Assessment Report of the IPCC (2007)). McKibben describes the report as "a

for the melting of glaciers does not fully track the speed with which they appear to be in fact breaking down.[10] Predictions from scientists studying the melting of the Greenland ice sheet, in particular, raise their estimation of sea level rise to one meter, if not more, by the year 2100.

Readers react differently to the IPCC projections of 0.4 to 0.6 meter rise for the coming century, and the less official and more contested estimations of a one-meter rise. Some think it unlikely that the sea could rise so much worldwide. Others find the estimates too small to be troubling.

As for the idea that it is not possible for the sea to rise that much, it is clear from geologic records that the sea level has been much higher in the past than it is today. "When the last glacial period ended approximately 12,000 to 16,000 years ago, the sea was about 100 meters lower than it is today because the oceans were colder and great amounts of water were stored in enormous ice sheets covering much of North America and Europe."[11] But at the peak of the last interglacial period some 120,000 years ago, the oceans were approximately six meters higher than today's level.[12] This perspective demonstrates that over long periods of time the sea level can, and has, fluctuate dramatically. The height the oceans attained 120,000 years ago, however, neither indicates that current global warming will result in that much of a rise over the next century, nor insures that six meters is the maximum that the sea could eventually rise.

The difference between the present sea level and the levels of the distant past is that a substantial amount of water is locked up in the major remaining ice sheets: those is Antarctica, Greenland and the Argentina-Chilean ice sheets. Jim Hansen of NASA writes that "the level of the sea throughout the globe is a reflection primarily of changes in the volume of ice sheets and thus of changes of global temperature."[13] The major ice sheets account for a significant percentage of today's glaciers; other glaciers are isolated pockets of ice. Glaciers around the world have been in retreat for some time, although the speed of that retreat appears to have recently increased. The most significant potential contributor to sea level rise at present comes from the breakup and melting of the Greenland ice sheet. A number of scientists studying

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remarkably conservative document," because it "sacrifices up-to-minute assessment of data in favor of lowest common-denominator conclusions that are essentially beyond argument . . . one result is that the 'shocking' conclusions of the new report in fact lag behind the most recent findings of climate science by at least several years." *Id.* at 45.

[10] *Id.* (stating the "[c]urrent climate models assume that the ice sheets will melt only slowly, as heat works its way down through ice more than two kilometers thick. But many glaciologists no longer believe this is what will happen").

[11] James G. Titus & Michael C. Barth, *An Overview of the Causes and Effects of Sea Level Rise* in Greenhouse Effect and Sea Level Rise 1, 7 (Michael C. Barth & James G. Titus, eds., 1984).

[12] *See, e.g.*, John F. Marshall & Bruce G. Thom, *The Sea Level in the Last Interglacial*, 263 Nature 120 (Sept. 9, 1976) (two to nine meters above present sea level).

[13] Jim Hansen, *supra* note 6 at 13.

the area point out that "Greenland alone could push-up sea level by three feet or so [one meter] over the next century."[14]

In time periods longer than this century, a greater sea level rise is predicted. Again, the IPCC noted:

> Very large sea-level rises that would result from widespread deglaciation of Greenland and West Antarctic ice sheets imply major changes in coastlines and ecosystems, and inundation of low-lying areas, with greatest effects in river deltas. There is medium confidence that at least partial deglaciation of the Greenland ice sheet, and possibly the West Antarctic ice sheet, would occur over a period of time ranging from centuries to millennia for a global average temperature increases of 1–4°C (relative to 1990–2000), causing a contribution to sea level rise of 4–6 m or more. This complete melting of the Greenland ice sheet and the West Antarctic ice sheet would lead to a contribution to sea-level rise of up to 7 m and about 5 m, respectively.[15]

As to the reaction that a one-meter rise is not that significant, two things need to be emphasized. First, in certain areas of the world, a one-meter rise will result in very significant flooding. For example, 17 percent of Bangladesh's land mass would be flooded by such a rise.[16] Similarly, Bill McKibben writes that "a couple of feet is enough to inundate many low-lying areas and drown much of the earth's coastal marshes and wetlands."[17] Second, it must be remembered that climate change will result in more than simple sea rise. Climate change is expected to also result in more intense storms and storm surges, thereby exacerbating local changes in coastlines, such as erosion, that already take place. It has not taken climatically driven sea level rise to alter, and even threaten, low lying islands and the communities that live, for example, in the Ganges River delta. Changes are already occurring.[18] Climate change will exacerbate these already visible changes and facilitate new ones. Work-

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[14] Tim Appenzeller, *The Big Thaw*, 211 National Geographic 56, 69 (Feb. 2007). The article goes on:

> The latest signs from Greenland have persuaded many ice researchers that sea level could rise three feet by 2100. Rignot [Eric Rignot of NASA], who has measured the rush of glaciers to the sea, says even that figure may turn out to be an underestimate. Greenland, he notes, could ultimately add ten feet to global sea level, and if this happens in the next hundred years instead of the next several hundred years, that's a very big deal.

See also Shankar Vedantam, *Glacier Melt Could Signal Faster Rise in Ocean Levels*, Washington Post, Feb. 17, 2006, at A1 (reporting that "The scientists said they do not yet understand the precise mechanism causing glaciers to flow and melt more rapidly, but they said the changes in Greenland were unambiguous – and accelerating").

[15] Climate Change 2007, *supra* note 8, at 16.

[16] *Those in Peril by the Sea*, The Economist 6, 8 (Sept. 9, 2006).

[17] Bill McKibben, *Warming on Warming*, The N. Y. Rev. of Books 44, 45 (Mar. 15, 2007).

[18] Somini Senguputa, *Sea's Rise in India Buries Island and a Way of Life*, N.Y. Times, Apr. 11, 2007 (Nat'l ed.), at A1 (reporting on a recent study by Sugata Hazra of Jadavpur University finding that "in the last 30 years, nearly 31 square miles of the Suandarbans have vanished entirely" and more than 600 families have been displaced). The IPCC WGII Fourth Assessment Report (2007)

ing Group II of the IPCC in its April 2007 report summarized the situation in this way: "Sea-level rise is expected to exacerbate inundation, storm surge, erosion and other coastal hazards, thus threatening vital infrastructure, settlements and facilities that support the livelihood of island communities."[19]

Thus, even a modest rise in sea level may have significant impact on coastlines and, as we will see in Part III, on geographic features that may serve as anchors for baselines.

IV. *Sea Level Rise, Uncertainty in Oceanic Boundaries and the Potential for Conflict*

Even a modest rise in sea level will be significant for ocean boundaries because, as discussed in Part II, those boundaries are generated from baselines that are often tied to rather insubstantial geographic features that will be among the first inundated by a rising sea level.

The fundamental reason that the inundation of some baselines by a rising sea level would cause uncertainty in oceanic boundaries is that both the baseline and the boundary generated by that baseline upon are "ambulatory," that is: (1) if a baseline anchor is submerged, then the baseline is redrawn on the basis of still valid exposed baselines points; and (2) the ocean boundary that was generated from the previous baseline is now redrawn to the new baseline.

Thus if the baseline moves, the boundary moves. If a baseline point such as an exposed rock disappears, the boundary generated by that point also disappears. Although this is obviously an important principle, it often goes unstated.[20] The 1982 Law of the Sea Convention does not expressly provide that the boundaries shall move with the baselines. It does, however, do so by negative implication. In particular, the Convention has a special rule for deltas which provides that when straight baselines are used in an area "[w]here because of the presence of a delta and other natural conditions the coastline is highly unstable, . . . notwithstanding subsequent regression of the low water line, the straight baselines shall remain

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states that the prospect of rising sea levels render the islands, ecology and people of the Ganges river delta among the threatened in the world.

[19] Climate Change 2007, *supra* note 8, at 12. The same report also states: "Coasts are projected to be exposed to increasing risks, including coastal erosion, due to climate change and sea-level rise. The effect will be exacerbated by increasing human-induced pressures on coastal areas." *Id.* at 7.

[20] It should also be noted that as a practical matter "that once the normal baseline has been established and cartographically depicted on large scale charts, it remains in place until such time as it is redrafted, irrespective of whether or not the actual low-water line has physically moved." D.C. Kapoor & Adam J. Kerr, A Guide to Maritime Boundary Delimitation 31 (1986). This circumstance, however, does not alter the legal question.

effective. . . ."[21] Arguably, the Convention also fixes the outer boundary of the continental shelf permanently. It provides that the "coastal state shall deposit with the Secretary-General of the United Nations charts and relevant information, including geodetic data, *permanently* describing the outer limits of its continental shelf."[22] Professor Bernard H. Oxman states that, given the fixed nature of investment in the continental shelf, the inclusion of the word "permanent" was intentional and that as far as the United States is concerned, its inclusion reflects earlier recommendations such as that made in an influential 1968 U.S. study: "The outer limit of the continental shelf should not be subject to change because of subsequent alterations in the coastline or revelations of more detailed surveys."[23]

No provisions, other than Article 7(2)'s deltaic baselines, however, address the possibility that there might be regression of baselines or operate to freeze maritime boundaries except possibly that of the outer continental shelf. Rather, the 1982 Convention appears to provide that in situations other than Article 7(2), the outer boundary of the EEZ, the contiguous zone and the territorial sea are ambulatory in that they will move with the baselines from which they are measured. As stated above, the conference of experts who met throughout the 1970s did not anticipate that there could be a significant regression of coastlines generally. Nonetheless, it is noteworthy that in the two cases where they were presented with concern over such a possibility – deltas, and arguably the outer edge of the continental shelf – the negotiating states were apparently willing to fix such boundaries permanently.

But will these shifts in baselines actually lead to any significant movement in boundaries? There is certainly reason to believe that in areas of the world with steeply rising coastlines that the projected rise in sea levels over the coming century will not have a significant impact on either baselines or boundaries. And although compiling a list of particular locations where a one-meter rise in sea level will result in substantial shifts in baselines is not the focus of this Chapter,[24] such a list is not necessary for the purposes of this Chapter because the previously described predisposition of the law of baselines virtually ensures that some significant problems will arise. In developing the law regarding maritime boundaries, states sought to maximize their claims over the ocean by supporting a liberal set of baseline rules that claim a fixed width and, in effect, extend zones further to sea.[25] The baseline rules do this by recognizing the least substantial points of land as valid baseline points.

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[21] 1982 Convention on the Law of the Sea, *supra* note 2, art. 7(2).

[22] *Id.* art. 76(9) (emphasis added).

[23] Telephone interview with Professor Bernard H. Oxman, University of Miami, Feb. 28, 1990, *referring to* Our Nation and the Sea 145 (1968).

[24] Identification of some areas is made in Eric C.F. Bird and John R.V. Prescott, *Rising Global Sea Levels and National Maritime Claims*, 1 Mar. Pol'y Rep. 177 (1989).

[25] *See, e.g.*, discussion of drying rocks in I Daniel P. O'Connell, The International Law of the Sea 191–95 (1982).

It is precisely these least substantial points that are most threatened by a rising sea level. These points of land fall into three main groups. First are low tide elevations, sometimes called "drying rocks." A low tide elevation can serve as a baseline point if it is located within what otherwise would be the territorial sea.[26] Assuming a drying rock was located just short of 12-miles from shore, permanent submergence of this rock by a rising sea level would mean a loss of as much as 12 miles in width of all ocean zones in that area.[27] Fringing reefs comprise the second category. Such reefs can serve as a baseline point regardless of whether they are within what otherwise would be the territorial sea of the island they fringe. Fringing reefs are often substantially distanced from the low water mark along the coast. Their submergence could result in an equally substantial reduction in the width of oceanic zones.

It is the third category, islands, however, that will potentially result in the most significant shifts. This is because islands, as opposed to uninhabitable rocks,[28] are entitled to a 200-mile-wide EEZ. An island could be an offshore barrier island which in a practical sense, only extends the maritime zones of a coastal state somewhat in the same way as a drying rock.[29] An offshore island could also be an anchor point of a straight baseline. Most significantly, a small island could be an island state or, more likely, one of a group of islands that form a state. This is significant because such island states do not merely extend the zones of the related adjacent coastal state, but can potentially generate an EEZ of their own, enclosing some 125,664 square nautical miles of ocean. Numerous island states exist. A rising sea level could taint the freshwater reservoir of an island, potentially rendering it an uninhabitable

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[26] The 1982 Convention, *supra* note 2, art. 13, repeating the text of Article 11 of the 1958 Convention, provides:

1. A low-tide elevation is a naturally formed area of land which is surrounded by and above water at low tide but submerged at high tide. Where a low-tide elevation is situated wholly or partly at a distance not exceeding the breadth of the territorial sea from the mainland or an island, the low-water line on that elevation may be used as the baseline for measuring the breadth of the territorial sea.
2. Where a low-tide elevation is wholly situated at a distance exceeding the breadth of the territorial sea from the mainland or an island, it has no territorial sea of its own.

[27] Bird and Prescott note that "a retreat of two nautical miles will have a significant impact on the location of the 12 nautical-mile outer limit of territorial seas, a proportionately smaller impact on the outer edge of the contiguous zone, which is 24 nautical miles distant and a negligible effect on the outer boundary of an exclusive economic zone 200 nautical miles wide." *See* Bird & Prescott, *supra* note 24, at 185–86.

[28] As to the distinction between an island and a uninhabitable rock in Article 121(3) of the 1982 Convention, *see* Jon M. Van Dyke, Joseph Morgan & Jonathan Gurish, *The Exclusive Economic Zone of the Northwestern Hawaiian Islands: When Do Uninhabited Islands Generate An EEZ?*, 25 San Diego L. Rev. 425 (1988).

[29] For a case study of such an offshore barrier island, *see* James Titus, *Greenhouse Effect, Sea Level Rise, and Barrier Islands: Case Study of Long Beach Island, New Jersey* 18 Coastal Management 65 (1990).

rock, submerge enough of it to leave only an uninhabitable rock, or submerge it entirely. In any of these circumstances, the island state would potentially lose its right to use that part of the island group to extend its EEZ. Consequently, for the island state, there is little doubt that the combination of a rise in sea level and the contingent nature of boundaries is, or will be, of grave concern.

My emphasis on these less than substantial baseline points should not be taken to imply that there may not be some areas of the world where a significant alteration might occur in the normal combination of the low water mark and closing lines. For example, in an action by the federal government of the United States against the State of Alaska, the U.S. argued that a closing line may no longer be drawn across a certain point of Kotzebue Sound because erosion of a shoal on one side of the sound had increased the closing line for the sound (a line limited under the law of baselines to 24 miles) from 23.9 miles to 25.8 miles in length. Consequently, the U.S. argued that the closing line must fall back miles into the sound until a maximum allowed width of 24 miles was reached again.[30]

Thus, given the changing circumstances, a rising sea level may potentially lead to shifts in boundaries in the ocean and, may even lead to disputes concerning the valid location of boundaries in the oceans. It must be remembered the ocean zones can be extremely valuable, both in terms of living resources and oil and minerals, and that states have fought over control of marine resources for centuries. It also should be recognized that the value of such resources may be much greater by the year 2100, particularly if global climate change causes great dislocations and alters food production in a more populated world. The IPCC describes the future situation in the developing world in the following terms:

> Many millions more people are projected to be flooded every year due to sea-level rise by the 2080s. Those densely-populated and low-lying areas where adaptive capacity is relatively low, and which already face other challenges such as tropical storms or local coastal subsidence, are especially at risk. The numbers affected will be largest in the mega-deltas of Asia and Africa while small islands are especially vulnerable. Adaptation for coasts will be more challenging in developing countries than in developed countries, due to constraints on adaptive capacity.[31]

This suggests that a rising sea level and the consequent implications of that rise for ocean boundaries may lead to both waste and conflict.

One plausible scenario for waste is that a state threatened with loss of oceanic areas will commit great amounts of resources to protect baselines threatened by a rising sea level, *not* because it cares about the baselines themselves, but rather because it values the oceanic zones that the baselines generate. In other words, one

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[30] *See* Law of the Sea Convention, *supra* note 2, art. 10.

[31] Climate Change 2007, *supra* note 8, at 6–7. *See also* Chapters 18 and 19 in Climate Change and Africa (Pak Sum Low ed., 2005).

behavioral risk is that countries will act to maintain the assumption of constancy underlying the law of baselines.

The hypothesis underlying this assertion is that an aspect of a legal order that continuously reincorporates the assumption of a constant climate will lead parties faced with a changing climate to react inefficiently. For example, assume that a portion of a legal order grants, and *then ties*, rights and entitlements to a physical aspect of the world, such as sea level, and presumes that the physical aspect is relatively constant. If the presumption of constancy is incorrect, then the rights and entitlements are potentially threatened. The holders of the entitlements may seek to preserve their rights and entitlements by committing resources to stabilize that aspect of the physical world which is threatened by climatic change. This is inefficient to the extent that resources are committed to preserve a physical aspect of the world, not because the aspect itself is valuable, but rather because the entitlements are valuable, and those entitlements, for purely conventional reasons, require its preservation. These costs are not only socially inefficient in that they do not relate to the production of wealth; they also do not relate to the potentially justifiable task of distributing wealth. These costs only ensure the retention of wealth.

An example of waste that could flow from the combination of a rising sea level and the present law of baselines is Japan's commitment of billions of yen to save Okinotorishima, two rocks located 1,400 yards apart and no more than two feet out of the water at high tide, from collapsing into the sea. Japan sought to preserve these rocks, not from a rising sea level, but from erosion by wave action, by constructing circular blocks of steel and concrete to save their deteriorating support.[32] Such expenditures will be yet more wasteful, if that is possible, amidst the full impact of global climate change in the next century. Far more important will be the need to relocate habitats and species, feed people and protect coastal infrastructures. Yet the present assumptions of our law of maritime zones encourage nations to expend funds to preserve baselines. Although a state may justifiably attempt to protect a headland against a rising sea level because the nation values something as intangible as the headland's beauty, a state should not be encouraged to preserve a headland *solely* because a dependent maritime zone is threatened.

A graver risk than waste of resources is that shifting baselines will lead to uncertainty as to the boundaries of some maritime zones, eventually causing conflict. Uncertainty regarding ownership of a valuable resource is a fertile ground for conflict between nations or between fishers of different nations. Indeed, one governmental advisor expressed concern to the author that during the possibly great strains accompanying climate change, states might question the fairness of past delimitation agreements with neighboring states. Even though states generally have a great interest in upholding the sanctity of such agreements, it is entirely plausible

[32] *See* the detailed Chapter by Yann-huei Song in this volume.

that a state might argue that circumstances had changed in that the parties had not foreseen such a rise in sea level.[33]

Thus, the risks of waste and conflict are part and parcel of the rule that oceanic boundaries should recede in step with the baselines from which they are measured. The simple possibility of losing part of its fishing ground will encourage states to allocate resources to preserve the baseline underlying that zone. The uncertainty as to whether a fishing ground is still within one state's exclusive economic control will tempt others to make use of the resource and create a situation ripe for conflict.

V. *Conclusion: A Proposal for Addressing the Uncertainty*

The risk identified in this Chapter is that of conflicts resulting from uncertainty in ocean boundaries as the seas rise, the root of which is the ambulatory character of most ocean boundaries. An obvious way to address this legal feedback is to modify the rule that gives rise to it. But, this legal feedback results from a collective rule which is difficult for any one state to authoritatively alter. This final section considers the avenues by which to accomplish precisely that, the procedures that might be required, and questions asked since an earlier version of this proposal was made.

The nub of the proposal is that states should move toward permanently fixing ocean boundaries and away from the current regime of ambulatory boundaries, and in doing so, design a process that will minimize costs and avoid possible abuse. As mentioned above, the fixing of boundaries is not new in the sense that the drafters of the 1982 Law of the Sea Convention quickly did so when confronted with the need to fix boundaries, such as the rule for deltaic formations. Nor is it new in the sense that many bilateral treaties on ocean boundaries fix the boundaries by reference to a chart, rather than by leaving their future position to be determined in accordance with possibly changing geographic features.

The fixing of oceanic boundaries would fulfill a primary value underlying theoretical constructs regarding boundaries, namely that they be certain and undisputed and thereby allow stability of expectations on both sides of the border. The current stability afforded by zones of a fixed width is contingent in that rests upon the assumption that the coastal or island formations from which the width is measured will remain relatively unchanged. A rising sea level, however, calls this assumption into doubt. Since uncertainty in boundaries is a prime ingredient in many recipes for interstate or private transnational conflict, maintaining the

[33] The reality of shifting baselines may be less significant in lateral delimitations because less substantial baselines points, such as drying rocks or even islands, may already have been discounted somewhat in the agreement. *See, e.g.*, Malcolm D. Evans, Relevant Circumstances and Maritime Delimitation 156–59 (1989).

current system of moving baselines invites such conflict. The fixing of boundaries would create more certainty.

Although there are no technical barriers to the fixing of oceanic boundaries, there are practical questions regarding costs and abuse. For example, one can imagine the fashioning of a process analogous to the Commission on the Outer Limits of the Continental Shelf, whereby the burden would be on the coastal state seeking to fix its maritime boundaries to file a declaration that its boundaries are fixed as of a certain date and to provide the scientific support – charts and satellite imagery – for their existence. Such a process would possibly limit abuse but obviously do so at a price.

But in considering the costs of such a process, it should also be borne in mind that uncertain boundaries also carry with them costs. The potential costs of adjustment are dramatically shown by the United States' experience with its Submerged Lands Act of 1953.[34] The Submerged Lands Act addressed the question of federal versus states' rights in the offshore seabed through a quitclaim by the United States to several states of lands underlying the waters within three miles of the coastline. The "coast line" was defined as "the line of ordinary low water along that portion of the coast which is in direct contact with the open sea and the line marking the seaward limit of inland waters."[35] In 1965, in *United States v. California*, the Court held that the line delimiting inland waters was to be determined in accordance with the 1958 Convention on the Territorial Sea and the Contiguous Zone.[36] By doing so, the Court rendered ambulatory the baseline described in the Submerged Lands Act. Given that title to valuable offshore oil reserves would move with this ambulatory baseline, litigation was inevitable, particularly in the case of Louisiana where the shoreline of the soft silt-like delta of the Mississippi River constantly shifts. In 1969 in *United States v. Louisiana*, the Supreme Court stated that because the Submerged Lands Act, referred to the 1958 Convention, it could not accept Louisiana's argument that the Court should adopt a fixed, rather than ambulatory, line. Justice Black in his Dissent wrote:

> [T]he doctrine is tending to bring about interminable litigation.... Shorelines are constantly changing, and under the Court's formula even this painstaking work cannot provide a means of marking the boundary for all time.
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> ....
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> [Adoption of a fixed boundary would have] put a stop to eternal litigation and help relieve this Court of the heavy burden repeatedly brought upon us to make decisions none of us have the time or competence to make.[37]

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[34] 67 Stat. 29, 43 U.S.C.A. §§ 1301–1315(West 2007).
[35] 43 U.S.C.A. § 1301 (c) (West 2007).
[36] 381 U.S. 139 (1965).
[37] 394 U.S. 85, 88 (1969).

To avoid such "interminable litigation," the federal government and Louisiana in effect froze the boundary by entering into a special boundary agreement – although even with the agreement, a final decree was not entered until 1981.[38] As a general solution to the possibility of such interminable litigation with other states, legislation was proposed in both the House and the Senate, authorizing the federal government to enter into seabed boundary agreements with the states and setting forth a process whereby such boundaries may become immovable.[39] "Interminable litigation" may be unlikely in an interstate context, but "interminable negotiation" and "occasional conflict" are quite possible.

Over the years since an earlier version of this proposal was first offered, two related questions have often arisen. First, is it equitable for a state to retain jurisdiction over an area of the ocean when the outer boundary is further than the authorized distance from the coast? Second (what I see as a natural law variation on the first question), since the right of a state in the ocean springs from the land, how can that right be maintained as the coastlines recedes or an island disappears entirely?

The key to understanding the equity aspects of the choice between continuing with ambulatory boundaries or fixing them on the basis of presently agreed baselines is that no state under a system of fixed boundaries would gain any more than it presently possesses. The present complex set of maritime zones resulted from an exhaustive balancing during the Third Law of the Sea Conference of the ocean-related interests of coastal states, maritime states, and the international community. These interests included fishing and fishery conservation, navigation, military uses, environmental and marine mammal protection, and marine law enforcement. Although the rules governing allocation would remain the same, the allocation of ocean space would in fact change if oceanic boundaries were to move with receding baselines. The fixing of maritime boundaries, on the other hand, does not affect the allocation agreed to at the Third Conference because it merely freezes the present division of authority over the oceans.

In essence, if one regards the allocation of authority arrived at by the Conference to be appropriate, then the fixing of maritime boundaries will, more than the present regime of ambulatory baselines, preserve this allocation. Simultaneously, we must bear in mind that it is entirely possible that global climate change may make

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[38] *United States v. Louisiana*, 452 U.S. 726 (1981). For a summary of the history of the case, *see United States v. Louisiana*, 446 U.S. 253 (1980).

[39] *See, e.g.*, S. 1878, 98th Cong. (1st Sess.); S. 2068 99th Cong. (2d Sess.). Both bills provided that the agreement on such a boundary would be without prejudice to the international claims of the United States. Although the proposal was ultimately not enacted, it provides an example of how concerns over uncertain boundaries might manifest in domestic legislation. *See* 98th CCH Cong. Index 14,244 (1983–84) (noting that S. 1878 was given to the Judiciary committee, and nothing further); 99th CCH Cong. Index 14,254 (1985–86) (noting that S. 2068 was given to the Energy and Natural Resources committee, and nothing further).

the present allocation of authority over the oceans to less desirable or equitable. For example, it is unclear whether changes in surface ocean temperatures will lead fisheries to move. It is at least equally unclear how the present system for fisheries management could adapt to such shifts. Such possibilities, however, do not alter the conclusion that fixed boundaries best preserve the division of authority over the world's oceans that resulted from the Third Law of the Sea Convention.

Thus, the preceding discussion suggests that the fixing of ocean boundaries on the basis of presently-accepted baselines would be wise because it promotes stability in boundaries, be fair because it preserves the present allocation of authority over the oceans, and be efficient because it avoids the costs of adjustment while facilitating adaptation to climate change.[40]

Legal feedbacks do not alter the amount of climate change, but instead aggravate the suffering that will accompany such change. It is a task of legal scholarship to aid societal adaptation to global climate change by identifying and addressing these legal feedbacks. The example of such a legal feedback mechanism discussed in this Chapter is the present law of baselines. In particular, it is argued that the rule that maritime boundaries should be tied to ambulatory baselines, will, as the result of a rising sea level, encourage wasteful spending by states and lead to uncertainty in boundaries and hence conflict. Thus, it is concluded that states should move toward fixing ocean boundaries on the basis of presently-accepted baselines.

The contingency of maritime boundaries upon the continued existence of baselines is a vestigial remnant of the naturalist's position that the existence of land is the source of authority over the ocean. That it has persisted through more positivist times reflects the fact that until recently, it was assumed that baselines were relatively constant. But, as we have come to realize that our assumption regarding the constancy of nature was simplistic and, inasmuch as nature declines to negotiate, it is we and our laws which must adapt.

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[40] I leave unaddressed whether the same analysis applies to the domestic use of ambulatory boundaries, for example, in dividing the public ownership of the littoral zone and the private ownership of land extending toward the beach. For a history and analysis of the use and abuse of the "ordinary high water line" in Florida, *see* Sara Warner, Down to the Waterline: Boundaries, Nature and the Law in Florida (2005).