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Imaginary islands?: options to preserve maritime jurisdictional entitlements and provide stable maritime limits in the face of coastal instability

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IMAGINARY ISLANDS?
OPTIONS TO PRESERVE MARITIME JURISDICTIONAL ENTITLEMENTS AND PROVIDE STABLE MARITIME LIMITS IN THE FACE OF COASTAL INSTABLILITY

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Abstract

The inundation of a disputed island in the Bay of Bengal in March 2010 was reported as an unlooked for benefit of climate change, eliminating the object of a contentious bilateral dispute. In fact this has not proved to be the case and the incident instead highlights the vulnerability of certain low-lying coastlines and insular features to significant and rapid changes in location, whether caused by sea level rise or not. While acknowledging ongoing debates on climate change and sea level rise, the paper examines key challenges in this context, notably concerning the ambulatory nature of normal baselines and the consequent potential impacts on the location of maritime jurisdictional limits derived from them. The paper goes on to suggest that the impacts of sea level rise on coasts and maritime claims will be unevenly felt before briefly outlining potential options with respect to retaining or securing maritime jurisdictional entitlements.

1. Introduction

Sea level rise linked to anthropogenically-induced global climate change is a potentially critical challenge for coastal States. Of fundamental concern is the threat that sea level rise could lead to the inundation of large areas of low-lying land territory, resulting in large-scale displacements of presently coastal-dwelling populations. An allied threat is that elevated sea levels could make coastal areas more susceptible to the impacts of events such as storm surges resulting from an increasing incidence of extreme weather events, likewise linked to climate change, resulting in such areas becoming less and less habitable.

This is an especially problematic prospect in light of the fact that coastal areas represent the most populated parts of the landmass. Pronounced rural-urban and interior/highland to coastal/lowland drift has, over time, resulted in heavy concentrations of global populations in low-lying coastal locations such that in broad perspective it has been estimated that over three billion people, or around half of the world's population, live

within 200km of the coast.[1] Further, a large number of these people live not only in close proximity to the coast but, crucially, on land territory that is very close to present sea levels. Indeed, it has been estimated that sea level rise of one metre would inundate territory presently occupied by around 60 million people.[2]

Sea level rise potentially poses an especially acute challenge to small, low-lying islands, and particularly States composed of such islands, as such features possess little in the way of elevated landmass for the coast (and coastal dwelling populations) to retreat to. Consequently, it has been posited that such islands, and accordingly entire States composed of such insular features, could be faced with total inundation of their land territory in the future.

While concerns over threats to land territory and the populations living in coastal areas represent an essentially inward, territorially focussed perspective, it is not the only concern raised by sea level rise. A further serious threat, discussed in this paper, is that posed seawards, that is, to the spatial extent of maritime jurisdictional entitlements. A brief overview of the contested debates on climate change and sea level rise is offered before the traditional linkage between ambulatory normal baselines and the maritime jurisdictional limits derived from them is explored. The likely uneven impact of sea level rise on maritime entitlements is highlighted before some of the options to preserve maritime entitlements in the face of sea level rise are briefly outlined.

The point of departure for the paper, and the rationale for its title, stems from the observation that at present many States opt for a very low low water line, as dictated by the choice of lowest astronomical tide (LAT) as their preferred vertical datum. As a consequence of using such a low 'zero' line to represent what in jurisdictional terms can be regarded as the 'edge of the land', States are opting to use a coastline that only rarely emerges from under the waves. For the vast majority of the time, therefore, the coastline chosen by many coastal States, including that of the small, low-lying islands, is submerged and thus effectively invisible or, to an extent at least, 'imaginary'.

2. Contested Debates

Climate change remains a hotly contested topic not only among scientists but also among policy makers and national/international leaders.[3] Debate continues between those who regard climate change as a reality and those who maintain it is a myth. Indeed, some people remain convinced that climate change is a deliberate hoax.[4] There appears to be little chance of a consensus or compromise emerging between these opposing perspectives.

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1 Walker, G. and King, D., *The Hot Topic: How to Tackle Global Warming and Still Keep the Lights On*, (London: Bloomsbury, 2008): 57.

2 Ananthaswamy, A. (2009) "Going, going…", *New Scientist*, 4 July 2009, 26, at 30-31.

3 See for example: "EU's new figurehead believes climate change is a myth", *The Times Online*, 2 January 2009, available at <http://www.timesonline.co.uk/tol/news/world/europe/article5430362.ece> (last accessed 31 August 2010).

4 Anthony Leiserowitz discussed five distinct reasons why people doubted the reality of global climate change. See: Leiserowitz, A. A. (2005) "American Risk Perceptions: Is Climate Change Dangerous?", *Risk Analysis*, Vol. 25, No. 6.

Debates also rage concerning the causes and the effects of climate change and these discussions similarly appear to be endless.[5] Nonetheless, there appears to be mounting scholarly and scientific evidence to suggest that climate change is indeed a reality. For example, changes to the seasons (that is, the duration of summer, autumn, winter, and spring) in some subtropical places are a reality.[6] The pattern of wet and dry seasons in tropical regions has also been changing.[7] Such scientific findings led the United Nations Intergovernmental Panel on Climate Change (IPCC) to conclude that not only is climate change a reality but that it is unequivocal that climate change is a human-induced process.[8]

Within this context, there is widespread recognition that sea level rise is also a reality. Indeed, averaging of tide-gauge records from around the world supports the contention that the overall volume of the oceans is increasing (at around 1.7mm per year over the past half century). It has also been suggested that the rate of increase is accelerating (with a rate of rise of around 3.1mm per year based on satellite measurements from the 1990s). Uncertainty does, however, persist concerning by how much the sea will rise and how swiftly it will do so.

The principle causes of sea level rise arise from the thermal expansion of the oceans and the disintegration of land-based ice sheets. The first of these, the so-called 'steric effect', occurs as a consequence of the increasing atmospheric temperatures associated with global warming. As air temperatures rise so, gradually and incrementally, the oceans also warm. As they warm, surface waters expand and this in turn translates to a rise in sea level. Considerable uncertainty surrounds the whether and how swiftly land-based ice sheets such as those of Antarctica and Greenland, are melting. Consequently, the IPCC did not factor in this potential loss leading to its relatively moderate predictions in its Fourth Assessment Report of 2007 estimating the range of sea-level rise at between 0.38 to 0.59 metres above 1990 levels by 2100, with a mid-range prediction of the order of 40 centimetres.[9]

This, in turn, led to criticism of the IPCC's conservative approach. Clearer evidence of the melting of grounded ice has led to predictions of significantly greater rises in sea level. For example, there have been strong indications of increased melting on the Greenland ice sheet which alone has enough water locked in it to raise global sea level by the order of six to seven metres were it to collapse and melt completely.[10] While it

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5 Some prominent scientists disagree that climate change is human-induced. See for example: Greenhouse effect is a myth, say scientists. Available at <http://www.dailymail.co.uk/sciencetech/article-440049/Greenhouse-effect-myth-say-scientists.html> (last accessed 2 September 2010)

6 See for example: Duzheng, Y. Yundi, J. and Wenjie, D., (2003). *The northward shift of climatic belts in China during the last 50 years and the corresponding seasonal responses*, Advances in Atmospheric Sciences, Volume 20, Number 6, pp. 959-967.

7 In 2007, an official from the Indonesian Ministry of Public Works stated that "Indonesia has been experiencing seasonal anomaly" [in Bahasa Indonesia]. Available at < http://www.pu.go.id/index.asp?site_id=001&news=ppw230507ida.htm&ndate=5/23/2007%203:47:48%20PM> (last accessed 30 August 2010)

8 The 4th Assessment Report of the Inter-governmental Panel on Climate Change (IPCC). Available at <http://www.ipcc.ch> (last accessed 31 August 2010)

9 See, the IPCC's Fourth Assessment Report (AR4), available on the internet at, <http://www.ipcc.ch/#> (last accessed 21 November 2009).

10 See, for example, Walker and King (2006: 778-80) who conclude that "Greenland is one of the most convincing reasons we have for the urgent need to curb climate change."

would necessarily take a considerable time for major bodies of ice to wholly disintegrate, collapse, and melt, clearly the potential for seal level rise greater than suggested by the oft-quoted IPCC figures exists. Accordingly, coastal States are bracing themselves for considerably higher sea level rises. For example the Australian Government's Department of Climate Change published *Climate Change Risks to Australia's Coast: A First Pass National Assessment*, in November 2009 which suggests a "plausible worst-case scenario" of a rise of 1.1 metres by 2100.[11]

It is appropriate to acknowledge that significant challenges exist in distinguishing sea level rise from background 'static', that is, ongoing long term cyclical changes as well as the influence of other processes. For example, research has suggested that land subsidence is partly responsible to the inundation of part of coastal area of Semarang City (Central Java, Indonesia).[12] Nevertheless, there are genuine and scientifically well-founded concerns that not only is the phenomenon real but that it is likely to seriously impact on a large proportion (arguably all) of the world's population. Similarly, there are persuasive indications that global sea level rise is likewise a reality. Sea level rise carries with it the threat that changes to coastlines, and particularly the location of the low water line, will have 'knock on' impacts on national claims to maritime jurisdiction.

3. Baselines and the Law of the Sea

In accordance with the United Nations Convention on the Law of the Sea 1982 (LOSC),[13] baselines are vital in defining the outer limits of maritime zones a coastal State is entitled to. Landward of a coastal State's baselines lie either its land territory, including the inter-tidal foreshore landward of normal low-water line baselines, or internal waters. Baselines serve as the starting point from where the outer limits of maritime zones, such as the territorial sea,[14] the contiguous zone,[15] the exclusive economic zones (EEZ)[16] and, to an extent, the continental shelf[17] are measured. In addition, baselines are also important in constructing equidistance lines between coastal States in the delimitation of maritime boundaries. In this context it is notable that

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11 Department of Climate Change (2009) *Climate Change Risks to Australia's Coast: A First Pass National Assessment* available at <http://www.climatechange.gov.au/en/publications/coastline/climate-change-risks-to-australias-coasts.aspx>.

12 See, Sutanta, H., Rajabifard, A. and Bishop, I. D. (2009) "An Integrated Approach for Disaster Risk Reduction Using Spatial Planning and SDI Platform", pp.341-351 in Ostendorf B., Baldock, P., Bruce, D., Burdett, M. and P. Corcoran (eds.), *Proceedings of the Surveying & Spatial Sciences Institute Biennial International Conference*, Adelaide 2009, Surveying & Spatial Sciences Institute. See also: Alam, M. (1996) "Subsidence of the Ganges-Brahmaputra Delta of Bangladesh and Associated Drainage, Sedimentation and Salinity Problems", pp.169-192 in Milliman, J. D. and Haq, B.U. (eds) *Sea-Level Rise and Coastal Subsidence*, Kluwer Academic Publishers.

13 United Nations Conventions on the Law of the Sea (LOSC), opened for signature 10 December 1982, in force 16 November 1994, 1833 UNTS 3.

14 LOSC, Part II

15 *Ibid*

16 LOSC, Part V

17 The definition of the outer limits of the continental shelf are necessarily only dependent on distance measurements from relevant baselines. Where areas of 'extended' or 'outer' continental shelf seawards of the 200 nautical mile limit are under consideration of the geology and geomorphology of the seabed are also critical. Nonetheless, distance measurements from baselines, especially the 200 and 350 nautical miles limits, are important parts of the equation in the determination of the outer limits of the continental shelf. See, LOSC, Article 76.

equidistance lines, the construction of which necessarily depend on the use of baselines, have proved to be by far the most popular method of delimitation.[18]

LOSC provides for multiple types of baselines: 'normal' baselines, straight baselines, river and bay closing lines, and baselines related to ports and roadsteads.[19] A state may use a combination of different types of baseline to construct the overall baseline around its coastline.[20] Additionally, archipelagic states[21] are able to define archipelagic baselines.[22]

Of particular note in the context of sea level rise, the normal baselines of a coastal State are the "low-water line along the coast as marked on large scale charts officially recognized by the coastal State."[23] In their designation, normal baselines do not require coastal States to make active claim or publication, unlike straight or archipelagic baselines. In addition, if a State does not publish any type of baselines, then it employs normal baselines since they are "a coastal state's default baselines."[24] This is the predominant type of baseline worldwide.

Article 5 of LOSC does not specify a particular low water line that should be used, this choice is left to the coastal state. The particular low water line opted for is, in turn, dependent upon the choice of the vertical level (technically the 'vertical datum') that represents 'zero' from which heights and depths are measured. This reference level intersects the coast as the low water line.

The rule of thumb is that the higher the vertical datum is, the closer landward the location of baselines will be. Similarly, the lower the vertical datum then the further 'down the beach' the low water line, and thus the starting line for the measurement of maritime claims, generally becomes. Unsurprisingly, States have tended to favour the application of low vertical datums in order to determine their low water lines and thus normal baselines. In practice, many coastal States favour the use of lowest astronomical tide (LAT) for this purpose. LAT is a particularly low vertical datum, and thus low water line, consisting of "the lowest level which can be predicted to occur under average meteorological conditions and under a combination of astronomical conditions."[25] LAT

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18 See, for example, Prescott, J.R.V. and Schofield, C.H. (2005) *The Maritime Political Boundaries of the World* (Leiden/Boston: Martinus Nijhoff Publishers), at pp.239-241.

19 LOSC Articles 5, 7, 9, 10, 11 and 12 respectively.

20 LOSC Article 14.

21 According to Article 46 of LOSC, an archipelagic state is one 'constituted wholly of one or more archipelagos' and other islands with an 'archipelago' consisting of 'a group of islands, including parts of islands' and interconnecting waters that are closely interrelated. Australia does not qualify as an archipelagic state under this definition.

22 LOSC art 47.

23 LOSC, Article 5

24 Beckman, R., and Schofield, C. (2009) "Moving Beyond Disputes Over Island Sovereignty: ICJ Decision Sets Stage for Maritime Boundary Delimitation in the Singapore Strait", *Ocean Development and International Law*, Vol. 40:1: 1-35, at p. 5.

25 See International Hydrographic Organization (IHO) (with the International Oceanographic Commission and the International Association of Geodesy), *A Manual on Technical Aspects of the United Nations Convention on the Law of the Sea, 1982*, Special Publication No 51, 4th edition, International Hydrographic Bureau, Monaco 2006, ch 2, 18. This publication is often referred to as the 'TALOS Manual'.

is based on observations made over a period of 18.6 years, "identified as the relative rotation of the lunar and solar orbits or regression of the lunar nodes."[26]

4. Ambulatory Baselines and Shifting Maritime Limits

It has long been recognised that parts of the coast are dynamic and can change location and configuration in relatively short periods of time or "ambulate".[27] Indeed, coastlines often change in a cyclical manner over time (alternately shifting seawards through deposition or accretion of material and then landwards as a consequence of erosion).[28] The location of normal baselines will therefore tend to move over time. The traditionally generally accepted implication of this phenomenon is that as normal baselines change, so too will the maritime jurisdictional limits measured from them. Thus, where the baseline advances (for example, by the deposition of material along the coast) the outer limits of the maritime claims measured from that baseline will likewise expand seawards. Conversely, where the normal baseline recedes (through coastal erosion), the coastal state may 'lose' maritime areas as their maritime limits are likewise pulled back.

Since normal baselines are represented by low-water line, sea level is an important issue in the definition of normal baselines. That said, whilst normal, low water line, baselines would seem to be most obviously susceptible to change as a consequence of sea level rise, other types of straight line type baseline are also potentially threatened by sea level rise as such baselines need to be anchored to the coast as represented by the low water line.

Rising sea levels will generally tend to lead to the retreat inland of the low water line, and thus the normal baseline. This can result in significant 'knock on' impacts on the limits of maritime jurisdictional claims if the basepoints, on which the limits of such claims depend, similarly retreat inland. This threat to the extent of national maritime jurisdictional claims is especially significant for coastal states such as Bangladesh which have large stretches of low lying coasts. The maritime claims of States in possession (or, indeed, entirely composed) of low elevation islands, are also under threat from this phenomenon. Small, remote and low lying islands can give rise to significant maritime jurisdictional entitlements. However, sea level rise could change the legal status of such insular features. For example, an island presently always above water surface even during high tide may, as a consequence of sea level rise, may eventually disappear during high tide. This could lead to it being reclassified from an island from which claims to the full range of maritime zones may be made, to one of the categories of insular formation from which only restricted maritime claims can be made such as a 'rock' or a low tide elevation (features that are exposed at low tide but are submerged at high tide) or even a fully submerged feature which cannot be used to generate maritime claims.[29]

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26 Sobey, R. J., (2005). *Extreme low and high water levels*, Coastal Engineering, Vol. 52, p. 65.

27 Reed, M. *Shore and sea boundaries: the development of international maritime boundary principles through United States practice*, (Washington D.C.: US Department of Commerce, 2000), at 185; Prescott and Schofield, Maritime Political boundaries of the World, supra note 22, at 100-101.

28 See, for example, Hirst, W. and Robertson, D., "Geographic Information Systems, Charts and UNCLOS – Can They Live Together?", *Maritime Studies*, 136 (May-June 2004), at 1-6.

29 Schofield, C.H. 'Shifting Limits?: Sea Level Rise and Options to Secure Maritime Jurisdictional Claims'(2009) 4 *Carbon and Climate Law Review*, pp.405-16, at pp.409-410.

5. Uneven Impacts

While, as noted above, sea level rise would logically and inevitably seem to result in the retreat of normal baselines inland, it is important to recognise coastal complexity and variability. Accordingly, sea level rise is likely to result in uneven consequences in terms of impacts on maritime jurisdictional claims.

For example, the gradient of the coast is an important factor. Where the coastline is relatively steep in gradient, the impact of sea level rise will be limited in terms of shifting the location of baselines (and thus the maritime jurisdictional limits derived from them) horizontally. Conversely, where the coastline is gently shelving, even relatively slight changes in sea level vertically can result in significant shifts in the location of the low water line horizontally and this, in turn, can have significant impacts on the spatial extent of national maritime claims.

Figure 1 illustrates two different sea levels and two distinct coastline gradients. The impact of a rise in sea level from Level 1 to Level 2 is significantly more pronounced in terms of the horizontal change or recession inland in the location of the normal baseline for the shallower gradient coastline shown. In short, the steeper the coastal area is, the less the impact will be. A very shallow foreshore gradient, for example 5% or less (around 3° measured from horizontal line), will be affected by around 20 meters of horizontal distance on the location of the normal baseline as a result of one meter difference in vertical datum. For the same difference in vertical datum, a steep foreshore gradient, for example 173% or more (around 60° measured from horizontal line), can be affected only by 0.5 meters of horizontal distance. In this context it is worth noting that errors in the definition of the vertical datum can also affect the location of baselines, which depends on the gradient of foreshore.[30]

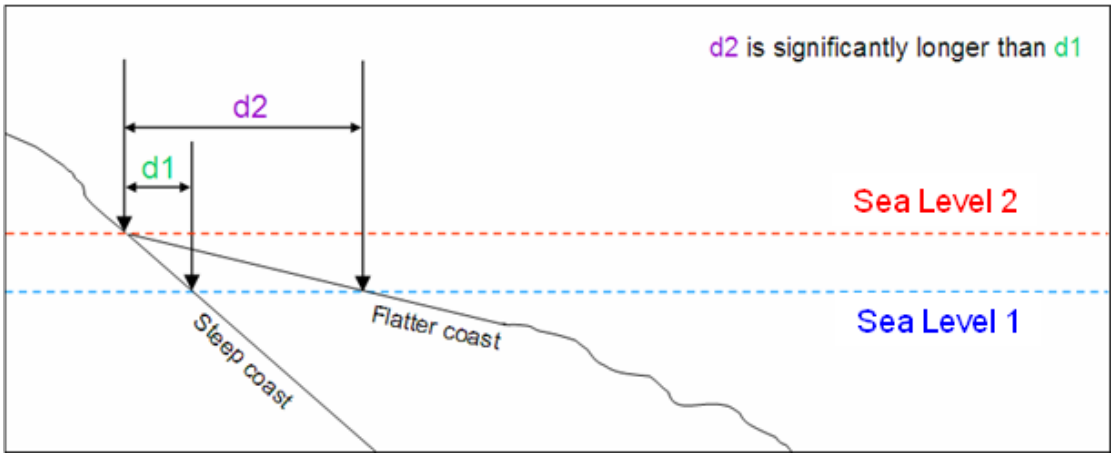

Figure 1 The impact of different sea levels on different gradients of coast

[30] Leahy, F.J., Murphy, B. A., Collier, P. A., and Mitchell, D. J., (2001). *Uncertainty Issues in the Geodetic Delimitation of Maritime Boundaries*, Proceeding of the 2001 ABLOS Conference. Available at <http:// www.gmat.unsw.edu.au/ablos/ABLOS01Folder/LEAHY.PDF> (last accessed 29 August 2010).

It is also the case that not all of a coastal State's baselines contribute towards the construction of the outer limits of its maritime claims. Maritime limits are commonly constructed through the 'envelope of arcs' method.[31] Consequently, only certain basepoints along the normal baseline, essentially the outermost points along the baseline such as headlands and offshore islands, will be relevant to the limits of the maritime zones with the length of the arcs from the contributing basepoints being determined by the breadth of the maritime zone for which the outer limit is being constructed. In contrast, those parts of the baseline that are, for example, located on the inner portion of a bay, are unlikely to contribute to the outer limit of maritime zones. Indeed, the majority of the baseline is irrelevant to the construction of the outer limits to maritime jurisdictional zones.

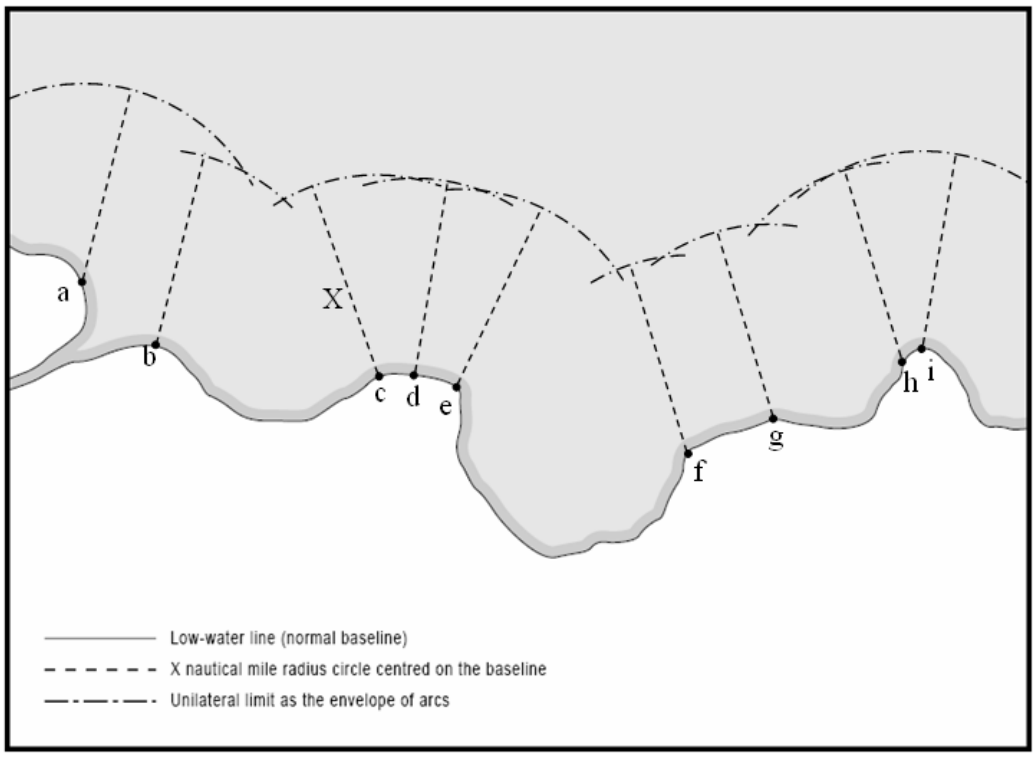

Figure 2 Envelope of arc and relevant basepoints

Figure 2 illustrates that, only points a, b, c, d, e, f, g, h, and i contribute to the construction of the envelope of arc which define the maritime limits. Any point along the baseline between e and f, for example, contribute nothing to the definition of maritime limits. Accordingly, should for some reason the e-f segment shifts landward, maritime limits will not be affected.

6. Islands and coasts under threat

While large populations occupying low-lying coastal areas on continental coasts are arguably most at risk from sea level rise, it is noticeable that the debate on the issue tends to be framed, even dominated, by the concerns of and about a number of small island States. This focus, especially in the media narrative, perhaps stems from a perception

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31 Carleton, C.M. and Schofield, C.H. (2001) *Developments in the Technical Determination of Maritime Space: Charts, Datums, Baselines, Maritime Zones and Limits*, Maritime Briefing, 3, 3, Durham: International Boundaries Research Unit, at p.62.

that, in contrast to small low-lying island States, continental States have other, higher, land for displaced populations to retreat to. Additionally, the small island States are well placed to readily (and arguably rightly) elicit sympathy for their apparent predicament, especially as the small island states can argue convincingly that they have done perhaps the least to cause global climate change through the emission of greenhouse gases.

Concerns over sea level rise by and on behalf of these States have been in large part prompted by recognition that certain States not only possess limited land territory but, more particularly, little territory elevated above present sea levels. For example, the highest point on the territory of the Maldives his only 2.4 metres above sea level. Similarly, it has been suggested that sea level rise is already a real emergency for Tuvalu, [32] which has accordingly been described as the "front line of climate change."[33] Analogous concerns exist for other small, relatively low lying, island States.

While it has been suggested that sea level rise could ultimately lead to certain low-lying island States sinking beneath the waves and thus losing their status as States,[34] this does not appear to be on the horizon at least in the near term. For example, even if sea levels were to rise by one metre, no State would be completely inundated. That said, even relatively slight sea level rises may have major impacts on island habitability. These concerns have led to the formation of bodies such as the Alliance of Small Islands States (AoSIS) has been established to address issues of their vulnerability to climate change.[35]

While there has been mounting evidence that impacts of sea level rise is generally negative, some may see it as an accidental benefit with regard in resolving sovereignty disputes. For instance, the alleged disappearance of a disputed island called South Talpatty (by Bangladesh) or New Moore (by India) was suggested as an unlooked for 'benefit' of climate change. However, in fact this did not prove to be the case as, not only were reports of the island's demise somewhat premature as it was reported that the island still appears during "very, very low tide conditions",[36] but (at least) one of the parties to the dispute, Bangladesh, promptly reasserted its sovereignty claim to the feature. It remains to be seen whether or not sea level rise will yet have a positive impact on long-standing, contentious island sovereignty disputes such as that over the Spratly

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32 A point noted by HE Mr. Enele Sosene Sopoaga, former Ambassador and Permanent Representative of the Mission of Tuvalu to the United Nations at the 2007 United Nations Framework Conference on Climate Change. See, Leake, J. (2007). Global warming and the world's low-lying countries, The Sunday Times. Available at <http://www.timesonline.co.uk/tol/news/environment/article3054040.ece> (last accessed 30 August 2010).

33 Patel, S. S. (2006) *A Sinking Feeling*, Nature Vol. 44, 6 April 2006, p. 734.

34 Article 1 of the *Montevideo Convention on the Rights and Duties of States* provides that a State should possess a "defined territory" and a "permanent population", as well as a government and the capacity to enter into international relations with other States. The first two of these four requirements could be directly impacted by sea level rise. See, *Montevideo Convention on the Rights and Duties of States*, opened for signature 26 December 1933, 165 LNTS 19 (entered into force 26 December 1934), Article 1.

35 See, Alliance of Small Islands States at <http://www.sidsnet.org/> (last accessed 1 September 2010).

36 Wade, M. (2009) *Rising sea level settles border dispute*, The Sydney Morning Herald. Available at <http://www.smh.com.au/environment/climate-change/rising-sea-level-settles-border-dispute-20100324-qwum.html> (last access on 28 August 2010).

Islands in the South China Sea or will merely add a further layer of confusion and uncertainty to already uncertain scenario.[37]

Notwithstanding mounting evidence suggesting threats to islands and coasts due to climate change, counterarguments do exist. For example, there is evidence to suggest that coral atolls have proven to be remarkably robust features over long time periods, including periods when sea levels were considerably higher than they presently are. This suggests that some insular features may be able to naturally adapt to climate change and sea level rise. It could also been argued that overpopulation of small islands, coupled with inappropriate land uses are important factors impacting on the integrity of, for instance, coral island ecosystems and thus the continued habitability of such features.

7. Response Options

Key options in response to sea level rise and its potential impact on maritime jurisdictional claims can be summarised as follows:

7.1 Coastal Protection

A traditional response when coastlines are threatened with erosion has been to protect them. Hard engineering options such as sea walls, groynes and wave reduction structures, notably revetments, offshore breakwaters, rock armour and gabions are generally designed to stabilise the location of the coast and protect key infrastructure located in the coastal zone. While "tried and tested", this type of approach has repeatedly demonstrated that such constructions can result in significant and problematic 'knock on' impacts to other parts of the coast, often through interrupting natural sediments flows. That said, this approach may remain appropriate to protect especially valuable parts of the coast and/or critical basepoints. A related approach involves reclamation works to, essentially, "build up" the coastline under threat.

Alternatively, 'soft' engineering approaches to stabilise, buffer or protect the coast and developments in the coastal zone have been developed. Examples include the creation of artificial wetlands, dune stabilisation measures, and efforts to encourage coastal revegetation such as through the planting of mangroves. Such efforts tend to replicate naturally occurring features that may have been previously removed through coastal developments (for instance the draining of wetlands to provide building land).

7.2 Planned retreat and relocation

Rather than attempting to protect the coast and stabilise its present location, one alternative would be to, in a sense, accept the inevitable and manage the impacts of rising sea levels. This can be achieved through "transformative" approaches which recognise increased dynamism in the coastal zone and thus provide for coastal development that is responsive rather than resistant to change. In this context "planned retreat" calls for coastal development to be removed/relocated once defined "setbacks" are encroached on through coastal erosion.

A more extreme scenario envisages the abandonment of entire islands. For example, the Indian island of Lohachara, located in the Sundarbans region where the Ganges and

[37] Dupont, A. (2008) *The Strategic Implications of Climate Change*, Survival, Volume 50: 3, p.36.

Brahmaputra rivers empty into the Bay of Bengal and once the home to 10,000 people, was reportedly evacuated due to the impacts of sea level rise.[38] Similarly, a decision was made in 2005 to relocate the 2,600 inhabitants of the Cateret Islands of Papua New Guinea are in the process of being evacuated in response to rising sea levels.[39]

7.3 Fixing baselines and maritime limits

An alternative option would be to legally fix or declare the location of normal baselines and/or the maritime limits derived from them.

This approach could be viewed as analogous to the deposition of charts or coordinates indicating the location of straight[40] or archipelagic[41] baselines. Over time it would seem likely that a tension would develop between the declared location of the baselines or the officially recognised chart for maritime jurisdictional purposes and (increasingly) reality as reflected in the charting used for navigation.

Ultimately, while such an approach might well be effective as a matter of domestic law, it is unclear whether this would be consistent with international law and the utility of such a policy would seem to turn on whether other States would be willing to recognise (or continue to recognise) claims made from "territory" that once was above high-water level but no longer is. While it is plausible that unilateral State practice could, in time and in the absence of protests, lead to the creation of a new customary rule on normal baselines, an alternative and arguably preferable approach would be to seek multilateral agreement on, effectively, a revised legal regime applicable to normal baselines. Although there appears to be scant enthusiasm among States Parties to embark on UNCLOS IV, a supplementary agreement that builds on the Convention, analogous to the Fish Stock Agreement of 1995, appears conceivable.[42]

In closing it can be observed that fixing baselines and/or maritime limits in effect merely preserves the existing rights of coastal States. It can be argued that this is hardly excessive. In addition, this effort is particularly important for small islands States which have arguably contributed the least to the emission of the greenhouse gases that are generally regarded as the key cause of climate change and thus sea level rise. Accordingly, it suggested that it is entirely equitable that such States be able to fix their baselines and maritime limits in order to retain their existing maritime entitlements, together with the valuable natural resources contained therein.

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38 Lean, G., "Disappearing World: Global Warming Claims Tropical Island", *The Independent*, 24 December 2006, available at, <http://www.independent.co.uk/environment/climate-change/disappearing-world-global-warming-claims-tropical-island-429764.html>. It should be noted that the island was evacuated "as a precaution" (*Ibid*.).

39 See: Migration, Climate Change and the Environment, International Organisation of Migration (IOM) Policy Brief - May 2009. Available at <http://iom.int/jahia/webdav/shared/shared/mainsite/activities/env_degradation/iom_policybrief_may09_en.pdf> (last accessed 27 August 2010).

40 LOSC, Article 16 (2).

41 LOSC, Article 47 (9).

42 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 (in force as from 11 December 2001), available at <http://www.un.org/Depts/los/convention_agreements/convention_overview_fish_stocks.htm> (last access on 3 September 2010).