Governance of Offshore Freshwater Resources

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ABSTRACT

Land-based supplies of freshwater are being increasingly exploited and polluted at the same time that climate change and burgeoning human population are causing widening scarcity and rising demand. Scientists have discovered that vast quantities of fresh to slightly brackish water reserves are sequestered in continental shelves around the world. These reserves take two completely different forms: aquifers and methane hydrates. Neither of these reserves has been commercially developed, and, while current technology could be utilized for aquifers, methods for extracting freshwater from methane hydrates do not yet exist. Given the vital and unique nature of freshwater, offshore freshwater resources will become more attractive as the quality and quantity of land-based supplies dwindle.

The purpose of this thesis is to fill the void in legal scholarship concerning governance of offshore freshwater resources. At least three different legal regimes are relevant: the UN Convention on the Law of the Sea, customary practices for offshore hydrocarbon development, and customary international law for land-based freshwater. All of these regimes have obligations to protect the environment and to cooperate with neighboring states, and all of them ensure sovereign rights to domestic natural resources while encouraging states sharing transboundary resources to seek equitable solutions. Similar to other natural resources, development of freshwater will have two distinct phases: access and distribution. Under current governance structures, access to and ownership of offshore freshwater would be assigned to coastal sovereigns, either exclusively or on a shared basis where the resource is transboundary. Distribution of natural resources has thus far been viewed as a prerogative of sovereign rights to access and ownership. However, emerging principles such as the human right to water, sustainable development and ecosystem protection

have begun to place limitations on unfettered distribution rights by directing that freshwater be allocated to certain beneficial purposes.

CHAPTER 1

INTRODUCTION

1.1 RESEARCH STATEMENT

This thesis examines governance of offshore freshwater, a relatively little known resource that has the potential to provide vast quantities of vital freshwater to water-scarce areas. Offshore freshwater is embedded in continental shelves and comes in two unrelated forms – aquifers[1] and methane hydrates[2]. Due to the continuing low price for land-based freshwater, development of the offshore freshwater resources has not yet begun in spite of their potential importance and magnitude. While legal structures utilized for development of offshore hydrocarbons are very well established, discussion of governance of offshore freshwater resources has only just begun.[3] The goal of this thesis is therefore to provide guidance to policy-makers and practitioners who may someday be tasked with determining rights and obligations that would attach to offshore freshwater and who will be creating governance structures to protect and enforce those rights and obligations.

As this chapter will describe, human conscription of freshwater resources has already created an imbalance between supply and demand through increasing reliance on dwindling water resources to support higher human populations and water-intensive lifestyles. The overdraft will grow more pronounced as climate change brings higher temperatures, extended droughts, locally intense rainfall and more limited agricultural production.[4] To provide enough

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[1] The origins, locations and characteristics of offshore aquifers are explained in Chapter 1.2.2.
[2] The origins, locations and characteristics of offshore methane hydrates are explained in Chapter 1.2.3.
[3] Renee Martin-Nagle, 'Transboundary Offshore Aquifers: A Search for a Governance Regime' (2016) 1.2 International Water Law
[4] The 2018 Summary for Policymakers from the Intergovernmental Panel on Climate Change provides a sobering account of the impacts of climate change without immediate action to reduce carbon emissions. Intergovernmental Panel on Climate Change, 'Global Warming of 1.5 °C: Summary for Policymakers' (WMO and UNEP 2018)

freshwater to meet the domestic, industrial and agricultural water demands of growing global populations, the search for additional supplies will doubtless lead eventually to offshore reserves of freshwater that are derived from unconventional sources.

However, development of these unconventional water supplies will not be easy or fast. Exploration and testing of offshore aquifers is in the early stages, and to date none of the confirmed reserves has been commercially exploited. Theoretically, drilling and recovery techniques similar to those utilized for offshore hydrocarbons could be seamlessly transferred to offshore aquifers that also contain liquids in subsea geological formations. Once recovered from the seabed, the water will have to be transported, either by tanker ships or through pipelines constructed to take it directly to coastal sites. The quality of water in the aquifers ranges from fresh to brackish, so treatment facilities will have to be available to render any brackish water suitable for human uses before the treated water is distributed to its final users. The technologies for all of these steps to extract, transport, treat and distribute water in offshore aquifers have been in use for decades, and utilization of the technology for a similar purpose should not encounter insurmountable technical barriers. In contrast, development of methane hydrates presents a much more difficult challenge, since the technology to extract them from the continental shelves without destroying the fragile ice clathrates is still in the very early stages of development. In addition, research into methane hydrates focuses on recovery of the valuable hydrocarbon methane, and, although frozen freshwater comprises more than eighty percent of the hydrate, no scientific studies exploring preservation and recovery of that freshwater have yet been published.

Assuming that any technical barriers are overcome, development of offshore freshwater resources will only be economically and politically feasible if the financial investment does not incur long-term losses. Adequate financial returns will likely depend on higher prices for water than at present, and,

according to the laws of supply and demand, prices will rise when supplies are low and demand is high. In a future where higher human populations require more freshwater for food, energy and domestic needs and where adequate quantities and quality of freshwater are limited, one can easily foresee a spike in prices for the most critically vital of all natural resources, one for which there is no substitute. Predicting the timing of this dystopian future is difficult, but its arrival is almost assured.

Once the technical and financial challenges have been addressed, nations will have to determine governance regimes to determine rights to offshore freshwater resources. Currently, international law assigns to coastal nations sovereign ownership of natural resources in the continental shelf that extends from their respective shorelines. However, guidance regarding transboundary offshore natural resources is limited, and nations are simply encouraged to find equitable solutions. To date, equitable solutions for transboundary hydrocarbons have taken the form of treaties that assign rights and obligations, require cooperation, and allocate the costs and benefits of developing the resources, but those governance regimes include only the states whose boundaries intersect the shared reserves, to the exclusion of geographically disadvantaged states such as those that are land-locked. Although states may reach bilateral agreements on governance of transboundary resources, they are also subject to broader obligations, both through treaties and through customary law. These obligations take the form of requirements to guard human rights and to protect the environment and its biodiversity. The analysis is further complicated by the fact that some offshore aquifers will be hydraulically connected to land-based aquifers, which could lead to a conflict of legal regimes. Further, methane hydrates may well be found in the outer continental shelf, where exploitation of natural resources is subject to benefit-sharing obligations.

This thesis therefore presents and evaluates how ownership and development of offshore freshwater will be addressed under current legal regimes. Since the

resource is located in the seabed, the first level of scrutiny must be the UN Convention on the Law of the Sea (LOSC).[5] Application of LOSC is both tempered and embellished by other legal regimes: regional seas agreements, bilateral agreements regarding transboundary natural resources, the Convention on Biological Diversity and customary law. LOSC and other marine-focused agreements may form the primary governing regime for offshore freshwater, but freshwater is a uniquely vital and irreplaceable resource with its own vibrant legal regime. In particular, the law of land-based transboundary aquifers is in the early stages of formation and may influence future guidelines on offshore aquifers. Thus, international water law must be explored for an understanding of the nuances that may be operative for offshore aquifers. Methane hydrates are currently classified and treated as hydrocarbons, so scrutiny of legal principles developed for offshore oil and gas will inform governance of the hydrates and will doubtless influence legal regimes for offshore aquifers. In closing, the thesis summarize and synthesize the laws applicable to offshore freshwater and will introduce emerging legal and philosophical trends that may impact allocation and distribution of offshore freshwater, such as the human right to water, benefit sharing, freshwater as a global commons and post-sovereign governance.

1.2 SETTING THE SCENE

The water currently on earth was likely delivered billions of years ago by asteroids and meteors[6], so, until celestial travelers deliver more of the liquid, the total volume of water on the planet can be considered to be finite. Ninety-seven percent of the total volume of 1.4 billion km^3 of water lies in the oceans in a saline condition[7] that renders it unusable for humans and most other terrestrial species without artificial treatment such as desalination. Of the non-

[5] United Nations Convention on the Law of the Sea (adopted 10 December 1982, entered into force 16 November 1994) 1833 UNTS 897 (LOSC)
[6] Julian Caldecott, *Water: Life in Every Drop* (Virgin Books Ltd 2007) 5-6; Gautam Naik, 'Rosetta Data Support View That Asteroids Brought Water to Earth' (*Wall Street Journal*, 10 December 2014)
[7] *Water Security for Better Lives* (OECD Publishing 2013) 125

saline freshwater, more than two-thirds of the global volume lies frozen in glaciers and polar ice caps, rendering that portion also unusable. Thus, only one percent of the water on the planet is capable of sustaining the human and terrestrial life that evolved to require it, and approximately ninety-six percent of that liquid freshwater is found in aquifer formations lying under the surface of the land.[8]

The human species has been remarkably successful in reproducing and extending its geographical presence on the planet. The global human population has increased from 1.2 billion in 1850[9] to 7.5 billion in 2017[10], with an expectation of reaching nine billion by 2050[11]. At the same time, people are flocking to urban environments where life-sustaining economic and natural resources are viewed as being more available and attainable. Since 1950, the number of people living in cities rose from 746 million to 3.9 billion in 2014, when urban dwellers comprised fifty-four percent of the global population.[12] By 2050, sixty-six percent of the global population, estimated to be 9.8 billion[13], is forecast to be living in urban areas[14]. To put this number in perspective, sixty-six percent of a global population of 9.8 billion equals 6.5 billion, which was the entire global human population in 2005.[15] Each of these people needs enough freshwater for drinking, sanitation, and food production, with the requirements of land-based ecosystems often assigned a lower priority.[16] A further

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[8] Timothy R Green and others, 'Beneath the surface of global change: Impacts of climate change on groundwater' (2010) 405 Journal of Hydrology 532, 540

[9] Michael Kremer, 'Population Growth and Technological Change: One Million B.C. to 1990' (1993) 108 The Quarterly Journal of Economics 681, 683

[10] *2017 World Population Data Sheet with a Special Focus on Youth* (Population Reference Bureau 2017) 1. <http://www.prb.org/pdf17/2017_World_Population.pdf> accessed 20 January 2018

[11] *Water Security for Better Lives* (n 7) 15

[12] *World Urbanization Prospects: The 2014 Revision (Highlights)* (United Nations 2014) 1

[13] *2017 World Population Data Sheet with a Special Focus on Youth* (n 10) 7; *World Population Prospects The 2017 Revision: Key Findings and Advance Tables* (United Nations 2017) 2

[14] *World Urbanization Prospects: The 2014 Revision (Highlights)* (n 12) 2

[15] Human Population: Population Growth (*Population Reference Bureau)* <http://www.prb.org/Publications/Lesson-Plans/HumanPopulation/PopulationGrowth.aspx> accessed 20 January 2018

[16] For example, the UN Watercourses Convention provides that conflicts over 'uses of an international watercourse' will be resolved 'with special regard being given to the requirements of vital human needs'. Convention on the Law of the Non-navigational Uses of International

complicating factor is that since the early twentieth century global wealth has been increasingly concentrated in only a few, mostly developed nations in the northern hemisphere[17] and by pervasive environmental degradation, both of which are self-sustaining and unjust to the 'bottom billion' of mankind and to non-human species that are experiencing loss of habitat and dwindling numbers[18].

This introduction to the thesis will begin with a brief explanation of the current and projected demand for freshwater in order to illustrate why development of offshore freshwater resources such as aquifers and methane hydrates may be viewed as an attractive and necessary endeavor in the coming years. To provide concrete understanding of the resources whose governance is the topic of this thesis, the chapter will then provide brief summaries of the scientific explanations regarding the existence, origins and characteristics of both offshore aquifers and methane hydrates.

1.2.1 Current and projected demand for freshwater

The concept of peak water, which was introduced in 2010 by Peter Gleick and Meena Palaniappan, describes a limit on water availability similar to peak oil where renewable water resources have been over-allocated, non-renewable groundwater has been over-abstracted, and ecosystems suffer degradation from insufficient water supplies.[19] Once a level of peak water has been reached, real

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Watercourses (adopted 21 May 1997, entered into force 17 August 2014) 36 ILM 700 (UN Watercourses Convention) art 10(2)

[17] According to a 2015 article in *Forbes* magazine, in 2014 only 10 nations held 83.5% of the global wealth. Those nations were United States (41.6%), China (10.5%), Japan (8.9%), United Kingdom (5.6%), Germany (3.9%), France (3.5%), Canada (3.0%), Italy (2.9%), Australia (2.0%) and South Korea (1.6%). Erik Sherman, 'America is the Richest, and Most Unequal, Country' (*Forbes*, 30 September 2015) < http://fortune.com/2015/09/30/america-wealth-inequality/> accessed 27 October 2017

[18] According to a WWF study, between 1970 and 2012 there was a decline of fifty-eight percent among 14,152 monitored populations of 3.706 vertebrate species. *Living Planet Report 2016: Risk and resilience in a new era* (WWF International 2016) 12

[19] Peter H Gleick and Meena Palaniappan, 'Peak Water: Conceptual and Practical Limits to Freshwater Withdrawal and Use' (2010) 107 Proceedings of the National Academy of Sciences 11155

limits on food and grain production appear[20], and water scarcity begins to affect the well-being of both people and ecosystems.[21] In a 2010 study, Charles J. Vörösmarty and others found that nearly eighty percent of the global population in 2000 lived in areas where water scarcity or threats to biodiversity were higher than in seventy-five percent of the rest of the planet.[22] A 2015 UN study concluded that more than a billion people lacked adequate freshwater[23], and two years later more than two and a half billion people (approximately one-third of the global population) did not have access to improved sanitation[24]. The consequential negative impacts on human society and on biodiversity can be easily imagined, as hunger produces conflicts over food, and losses of ecosystems services lead to species extinction and natural disasters. In fact, in 2013 the European Union Council and the United States (US) intelligence agencies predicted international conflicts over access to water in the coming decade.[25]

Demands for more freshwater have increased exponentially since the middle of the twentieth century. As a result of rapid population growth and economic development, water withdrawals in the past fifty years have risen by three hundred percent, and groundwater withdrawals have increased by one thousand percent, driven primarily by agriculture.[26] In addition, the rate of

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[20] Lester Brown, 'The real threat to our future is peak water' (*The Guardian,* 6 July 2013) <http://www.guardian.co.uk/global-development/2013/jul/06/water-supplies-shrinking-threat-to-food> accessed 20 January 2018

[21] Gleick and Palaniappan (n 19) 11155

[22] Charles J Vörösmarty and others, 'Global threats to human water security and river biodiversity' (2010) 467 Nature 555, 556. This study also found that '[r]ich countries tolerate relatively high levels of ambient stressors, then reduce their negative impacts by treating symptoms instead of underlying causes of incident threat.' ibid 559

[23] United Nations World Water Assessment Programme, *The United Nations World Water Development Report 2015: Water for a Sustainable World* (United Nations Educational, Scientific and Cultural Organization 2015) 19. One study estimated than in 2000 more than two and a half billion people were experiencing water scarcity. Simon N. Gosling and Nigel W. Arnell, 'A global assessment of the impact of climate change on water scarcity' (2016) 134 Climate Change 371, 374

[24] United Nations World Water Assessment Programme, *The United Nations World Water Development Report 2017.Wastewater: The Untapped Resource* (United Nations Educational, Scientific and Cultural Organization 2017) 2

[25] *The Multi-track Water Diplomacy Framework: A Legal and Political Economy Analysis for Advancing Cooperation over Shared Waters* (The Hague Institute for Global Justice, 2016) 2

[26] *Water Security for Better Lives* (n 7) 15

increase in water demand is twice the rate of increase in population.[27] Higher incomes in developing countries have led to changing dietary patterns that demand more water-intensive processed foods and meat protein.[28] Agriculture already accounts for approximately seventy percent of global freshwater use[29], with half of irrigation water[30] and one-third of all water withdrawals being sourced from groundwater[31]. Decreasing availability of surface water, both in terms of quantity and quality, consequently results in greater reliance on groundwater. As Jay Famiglietti of NASA's Jet Propulsion Laboratory at the California Institute of Technology notes, '[M]ost of the major aquifers in the world's arid and semi-arid zones, that is, in the dry parts of the world that rely most heavily on groundwater, are experiencing rapid rates of groundwater depletion'.[32] Aquifers in Asia and North America are particularly affected due to large and growing agricultural demands[33], but aquifers in the Near East, North Africa and Central America are also being depleted at unsustainable rates[34]. There are estimates that, if current rates of groundwater depletion continue, the number of humans experiencing water stress will grow to three billion by 2035.[35]

International organizations are unanimous in painting bleak scenarios about the future of water consumption and scarcity. In a joint report, the United Nations (UN) Food and Agriculture Organization (FAO) and the World Water Council predicted sufficient supplies of water to support food production in 2050, but

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[27] *The United Nations World Water Development Report 2015: Water for a Sustainable World* (n 23) 11
[28] Joshua Elliott and others, 'Constraints and potentials of future irrigation water availability on agricultural production under climate change' (2014) 111 PNAS 3239
[29] *Water and Jobs; Facts and Figures* (UN Water 2016) 3
[30] JS Famiglietti, 'The Global Groundwater Crisis' (2014) 4 Nature Climate Change 945, 947.
[31] ibid 945
[32] ibid 946. Another article confirmed these trends through analyses provided by the satellite program Gravity Recovery and Climate Experiment (GRACE). M Rodell and others, 'Emerging trends in global freshwater availability' (2018) 557 Nature 651
[33] Tom Gleeson and others, 'Water balance of global aquifers revealed by groundwater footprint' (2012) 488 Nature 197, 197
[34] *Towards a Water and Food Secure Future* (Food and Agriculture Organization of the United Nations and World Water Council 2015) 16
[35] Green and others (n 8) 543

with many regional and substantial scarcities.[36] Further, excessive pollution from urbanization, industrial development and agriculture will render critical bodies of water unusable for domestic or agricultural purposes.[37] Echoing these concerns, the Organization for Economic Cooperation and Development (OECD) estimates that between 2000 and 2050 world water use will increase by fifty-five percent, mostly to produce seventy percent more food[38], and that by 2050 forty percent of the global population will live in river basins experiencing severe water stress.[39]

Although in 2000 Charles Vörösmarty and others opined that higher human population and economic development will have the greatest impacts on future water availability[40], climate change is expected to compound the stresses that higher populations and economic development will place on water.[41] One recent analysis suggested that by the end of the century 'under the high emissions scenario RCP 8.5, average worldwide monthly population exposed to extreme drought (SPEI < -2) will increase by 386.8 million to 472.3 million (+426.6% from the current 89.7 million)', with anthropogenic climate change responsible for nearly sixty percent of the total.[42] In its Fifth Assessment Report issued in 2014, the Intergovernmental Panel on Climate Change (IPCC) made some striking predictions and projections about the impact of climate change on water availability. The IPCC noted the negative synergies of higher temperatures, heavier downpours carrying more sediment, nutrient and

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[36] *Towards a Water and Food Secure Future* (n 34) 8
[37] ibid 16
[38] *Water Security for Better Lives* (n 7) 131. The 2015 UN World Water Assessment Program report predicted that by 2050 60% more food will have to be produced globally, with the amount needed in developing countries doubling from the 2015 levels. *The United Nations World Water Development Report 2015: Water for a Sustainable World* (n 23) 3

[39] *Water Security for Better Lives* (n 7) 130
[40] Charles J Vörösmarty and others, 'Global water resources: vulnerability from climate change and population growth' (2000) 289 Science 284, 285, 287
[41] Robert I McDonald and others, 'Urban growth, climate change, and freshwater availability' (2011) 108 Proceedings of the National Academies of Science 6312, 6314; Jacob Schewe and others, 'Multimodel assessment of water scarcity under climate change' (2014) 111 Proceedings of the National Academies of Science 3245, 3249
[42] Oleg Smirnov and others, 'The relative importance of climate change and population growth for exposure to future extreme droughts' (2016) 138 Climate Change 41,41

pollution into water supplies, and higher concentrations of pollution due to evaporation from droughts, as well as damage to water treatment facilities resulting from floods.[43] The IPCC went on to predict widespread water scarcity in both urban and rural areas by 2100, with consequential deleterious impacts on health and agriculture[44] and 'intensifying competition for water among sectors'[45].

In its own 2014 report, the World Bank concurred, raising awareness about the consequences of higher temperatures that will result if drastic actions to reduce climate-change inducing emissions are not taken:

> Precipitation changes are projected under continued warming with substantial, adverse consequences for water availability. Central America, the Caribbean, the Western Balkans, and the Middle East and North Africa stand out as hotspots where precipitation is projected to decline 20–50 percent in a 4°C world. Conversely, heavy precipitation events are projected to intensify in Central and Eastern Siberia and northwestern South America with precipitation intensity increasing by around 30 percent and flooding risks increasing substantially in a 4°C world.[46]

Another scenario has forecast that by 2050 between three and four billion people – more than half the projected human population in 2050 -- will experience water scarcity due to the effects of climate change.[47] While some areas experience water scarcity, climate change will bring floods to other parts

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[43] ibid 69

[44] Core Writing Team, RK Pachauri and LA Meyer (eds), *Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* (IPCC 2015) (*Climate Change 2014: Synthesis Report*) 15-16. The IPCC Fifth Assessment Report also predicts that effects of climate change on freshwater will not be uniform across the globe, with high latitudes, mid-latitude wet regions and the equatorial Pacific experiencing additional rainfall and more intense storms by 2100, whereas mid-latitudes and subtropical dry regions will receive less precipitation. ibid 60

[45] ibid 69

[46] *Turn Down the Heat: Confronting the New Climate Normal* (World Bank 2014) xix

[47] Gosling and Arnell (n 23) 380

of the world.[48] According to OECD projections, at the same time that more water is needed for food production, other sectors such as industry, energy and domestic users will have their own heightened demands for water,[49] leading to even more absolute scarcity. Meanwhile, as demand for more quantities of water soar, water quality will diminish in the coming decades due to nutrient pollution, eutrophication and contaminants.[50] Even climate change mitigation contributes to water stress. The Carbon Disclosure Project estimates that twenty-four percent of emissions reduction projects require access to adequate freshwater supplies.[51] As the OECD warns, '[o]verall, the water demand outlook is not optimistic',[52] and '[t]he outlook for water quality is not optimistic either'.[53]

For all of these reasons and more, the 2018 report by the World Economic Forum (WEF) regarding global risks listed water crises as one of the five most impactful risks facing humanity.[54] In fact, WEF has listed water crises among the top five 'global risks in terms of impact' every year from 2012 through 2018, and in 2015 changed the designation from an environment factor to a societal factor.[55] The report noted that the effects of climate change on water crises included mass migrations of people who will require both food and water in their new locations[56], leading to local and regional insecurity. The sixth of the seventeen Sustainable Development Goals aspires to 'ensure availability and sustainable management of water and sanitation for all'[57], yet economic development puts even greater stress on water supplies due to water-intensive energy production. In developing countries, agriculture is responsible for a global average of eighty percent of water withdrawals, with only ten percent

[48] *Climate Change 2014: Synthesis Report* (n 44) 15
[49] *Water Security for Better Lives* (n 7) 135
[50] ibid 136
[51] *Thirsty business: Why water is vital to climate action* (Carbon Disclosure Project 2016) 3
[52] ibid 135
[53] ibid 136
[54] *The Global Risks Report 2018* (13th edn, World Economic Forum 2018) fig 4, v
[55] ibid
[56] ibid 12
[57] *The Sustainable Development Goals Report 2016* (United Nations 2016) 6, 22

allocated to industry, whereas in developed countries sixty percent of water withdrawals are for industry and energy, with only an average of thirty percent being dedicated to agriculture.[58] In the US, the energy sector alone commands forty percent of the fresh water usage, and in Europe over thirty percent of water use is for energy. Asia's soaring rate of economic development is anticipated to translate into a need for seventy percent more water by 2030 to meet industrial and energy demands,[59] largely due to more coal-fired electricity generation and biofuel production.[60] As the UN World Water Assessment Programme explains, 'Frequently, the environment, as well as marginalized and vulnerable people, are the biggest losers in the competition for water.'[61]

The factors affecting future water demand and availability sound like the convergence of a perfect storm: higher human populations with more water-exigent dietary habits, higher economic development with more water-intensive energy needs, continued and amplified global climate change with large areas of the world experiencing severe water stress and others experiencing floods, unsustainable depletion and contamination of both surface water and groundwater, and deterioration of vital ecosystems. None of these factors will be easily changed or quickly corrected, as conflicts, sectarianism and political and economic parochialism and paralysis prevent adoption or even full assessment of better alternatives. At the moment, traditional sources of freshwater include rainwater, surface water such as rivers and lakes, and groundwater from aquifers. However, when the perfect storm arrives with all of its force and fury, non-traditional sources of freshwater such as offshore aquifers and methane hydrates may show promise as viable alternative catchments of a uniquely essential and irreplaceable resource. Indeed, faced with chronic shortages of freshwater, coastal nations, where an estimated

[58] *Water Security for Better Lives* (n 7) 131
[59] *The Global Risks Report 2018* (n 63) 13
[60] *Water Security for Better Lives* (n 7) 132
[61] *The United Nations World Water Development Report 2015: Water for a Sustainable World* (n 19) 11

twenty-seven percent of the human population lived in 2010[62], may determine that access to offshore freshwater should serve as an integral component of their plan for freshwater security.[63] Offshore aquifers and methane hydrates are unlike one another in nearly every sense except that they both have the potential to supply freshwater. Thus, their origins and characteristics will be explored and explained separately.

1.2.2 Offshore aquifers

Since the US Geological Survey discovered the first offshore aquifer under Nantucket Island in 1976[64], subsequent expeditions have encountered them with increasing frequency[65]. In fact, Koos Groen and others proposed that offshore aquifers lying under continental shelves 'may be the rule rather than the exception.'[66] These caches of fresh to slightly brackish water[67] are distinguished from submarine groundwater discharge, which forms active undersea freshwater springs that have been documented for thousands of years but that do not confine water in geological formations.[68]

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[62] Matti Kummu and others, 'Over the hills and further away from coast: global geospatial patterns of human and environment over the 20th–21st centuries' (2016) Environmental Research Letters 11 034010, 6 http://iopscience.iop.org/article/10.1088/1748-9326/11/3/034010/pdf accessed 31 August 2018

[63] When Cape Town, South Africa, experienced severe water scarcity in 2017-8, questions were asked about accessing its offshore freshwater resources. Evan Lubofsky, 'A massive freshwater reservoir at the bottom of the ocean could solve Cape Town's drought — but it's going untapped' (*The Verge*, February 15, 2018) <https://www.theverge.com/2018/2/15/17012678/cape-town-drought-water-solution> accessed 31 August 2018

[64] FA Kohout and others, 'Fresh Ground Water Stored In Aquifers Under The Continental Shelf: Implications From A Deep Test, Nantucket Island, Massachusetts' (1977) 13 Water Resources Bulletin 373; John C Hathaway and others, 'U.S. Geological Survey Core Drilling on the Atlantic Shelf' (1979) 206 Science 515, 523

[65] Vincent EA Post and others, 'Offshore fresh groundwater reserves as a global phenomenon' (2013) 504 Nature 71

[66] J (Koos) Groen and others, 'Fresh and Moderately Brackish Groundwaters in Coastal Plains and Continental Shelves: Past and Ongoing Natural Processes' (2000) Proceedings 16th Salt Water Intrusion Meeting (Poland) 5

[67] In their widely disseminated article on offshore aquifers, Post and others defined slightly brackish water as having 'a minimum concentration of total dissolved solids (TDS) less than 10 g l^{-1}, which is about one-third of the salinity of sea water'. Post and others (n 74) 71

[68] H Kooi and J Groen, 'Offshore continuation of coastal groundwater systems; predictions using sharp-interface approximations and variable-density flow modelling' (2001) 246 Journal of Hydrology 19, 20; Hugues Faure, Robert C Walter and Douglas R Grant, 'The coastal oasis: ice age springs on emerged continental shelves' (2002) 33 Global and Planetary Change 47, 52;

Offshore aquifers formed during the Quaternary Period (beginning 2.588 million years ago and including the present) when sea levels were on average fifty to one hundred feet lower than present levels[69] due to the vast quantities of water that were conscripted into glaciers during the last glacial maximum (LGM)[70]. For at least ten thousand years during the LGM, what are currently continental shelves – an additional fifteen to twenty million square kilometers of land[71] -- were exposed to meteoric conditions[72], allowing freshwater precipitation and runoff to soak into soil and be sealed into place by confining layers of clay and other dense materials. In addition, in the northern latitudes the glaciers themselves forced water into the underlying soil through a combination of meltwater and land deformation caused by the sheer weight of the glaciers.[73] In deference to the length of time that these aquifers have sheltered their liquid treasure, the term "paleowater" was coined by scientists who were studying the phenomenon.[74] Offshore aquifers fall into two general

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Makoto Taniguchi and others, 'Investigation of submarine groundwater discharge' (2002) 16 Hydrological Sciences Journal 2115, 2116; Tor Haakon Bakken, Fridtjof Ruden and Lars Erik Mangset, 'Submarine Groundwater: A New Concept for the Supply of Drinking Water' (2012) 26 Water Resource Management 1015, 1017

[69] Harold Meisler, P Patrick Leahy and Leroy L Knobel, *Effect of Eustatic Sea-Level Changes on Saltwater-Freshwater in the Northern Atlantic Coastal Plain* (U.S. Geological Survey 1984) 1. A report from the European PALAEAUX project stated that for ninety percent of the past one hundred twenty thousand years, sea levels have been much lower than they are today, and sea levels are higher today than they have been for approximately one hundred thousand years. WM Edmunds, 'Palaeowaters in European coastal aquifers - the goals and main conclusions of the PALAEAUX project' in WM Edmunds and CJ Milne (eds), *Palaeowaters in Coastal Europe: Evolution of Groundwater since the Late Pleistocene* (The Geological Society of London 2001) 5

[70] Kurt Lambeck and John Chappell, 'Sea Level Change Through the Last Glacial Cycle' (2001) 292 Science 679, 681; Faure, Walter and Grant (n 67) 47

[71] Faure, Walter and Grant (n 77) 48

[72] Groen and others (n 75) 3

[73] Mark Person and others, 'Pleistocene hydrogeology of the Atlantic continental shelf, New England' (2003) 115 GSA Bulletin 1324, 1325, 1327, 1339; Mark Person and others, 'Pleistocene Hydrology of North America: The Role of Ice Sheets in Reorganizing Groundwater Flow Systems' (2007) 45 Reviews of Geophysics 1, 18; Denis Cohen and others, 'Origin and Extent of Fresh Paleowaters on the Atlantic Continental Shelf, USA' (2010) 48 Ground Water 143, 154. Based on a review of scientific studies, Bakken, Ruden and Mangset noted at least six possible mechanisms for emplacement of offshore freshwater, some of which may occur simultaneously: sub-glacial injection; pro-glacial injection with distal permafrost as confining layer; recharge during Pleistocene sea level low-stands; modern flow cell with recharge from land; entrapment of connate water in rapidly subsiding basins, and release of water by the melting of gas hydrates. Bakken, Ruden and Mangset (n 77) 1017

[74] Groen and others (n 75) 3; Edmunds (n 78) 2

categories – free-standing aquifers and aquifers that are hydraulically connected to land-based aquifers.[75] Over time, saltwater will intrude into these aquifers through the overlying marine clay layers and the underlying saline soil deposits[76], and increasing distance from shore will in most cases result in a higher salinity content of the aquifer waters[77]. However, in aquifers closer to shore freshwater remains safely encased in relatively impermeable confining layers[78], and even the brackish water in more distant aquifers will be fresher than seawater and thus easier and cheaper to desalinate.[79]

Offshore aquifers have been found in the seabeds of every continent, with the northeast coast of the United States[80] and northern Europe[81] being the most intensely studied and documented. Scientific evidence of the presence of fresh to slightly brackish water has also been documented off the coast of Surinam[82], South Africa[83], Peru[84], Greenland[85], Australia[86] and Tanzania[87]. Freshwater reserves have been found at depths of over five hundred meters[88] and up to one hundred fifty kilometers (80 nautical miles) from shore.[89] Along the Atlantic coast of the US, the offshore aquifers are normally between fifty meters and two hundred meters thick, with confining layers measuring between ten meters and

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[75] Hathaway and others (n 73) 523; Kooi and Groen (n 77) 19
[76] J Groen, J Velstrab and AGCA Meesters, 'Salinization processes in paleowaters in coastal sediments of Suriname: evidence from δ37 Cl analysis and diffusion modelling' (2000) 234 Journal of Hydrology 1; Bakken, Ruden and Mangset (n 77) 1019
[77] The map in Post and others (n 74) 73 illustrates how distance from shore results in higher TDS values.
[78] Groen, Velstrab and Meesters (n 85) 2
[79] Post and others (n 74) 71, 76
[80] ibid
[81] Edmunds (n 78) 14
[82] Groen, Velstrab and Meesters (n 85) 2
[83] Post and others (n 74) 72
[84] Cornelia Kriete, Axel Suckow and Bodo Harazim, 'Pleistocene meteoric pore water in dated marine sediment cores off Callao, Peru' (2004) 59 Estuarine, Coastal and Shelf Science 499.
[85] Whitney DeFoor and others, 'Ice sheet–derived submarine groundwater discharge on Greenland's continental shelf' (2011) 47 Water Resources Research 1
[86] Sunil Varma and Karsten Michael, 'Impact of multi-purpose aquifer utilisation on a variable-density groundwater flow system in the Gippsland Basin, Australia' (2011) 20 Hydrogeology Journal 119, 123
[87] Bakken, Ruden and Mangset (n 77) 1018
[88] Person and others 2003 (n 82) 1324. This borehole was drilled on Nantucket Island and passed through the full Cretaceous sedimentary package.
[89] ibid

fifty meters.[90] Estimates of the volume of water in offshore aquifers vary. In 2010 Denis Cohen and others estimated the total volume of Pleistocene-era freshwater (less than 1 part per thousand saline) under the continental shelf along the northeast coast of the United States to be approximately 1300 km^3. They further estimated that the US Atlantic eastern seaboard could contain 10^4 km^3 of fresh water, and global continental shelves could harbor a staggering 3×10^5 km^3 of freshwater.[91] However, in an article published in 2013, Vincent Post and others postulated that the volume of fresh and brackish water is equivalent to 4500 km^3, or one hundred times the volume of freshwater that has been extracted from land-based aquifers since 1900.[92] While the estimates may vary, they all agree that offshore aquifers house impressively large caches of fresh to brackish water.

As evidence of the extent and frequency of the offshore aquifers mounted, researchers began to suggest that these freshwater reserves may serve as additional sources of potable water.[93] Further, Mark Person and others have recommended that the low salinity of water found in offshore aquifers be utilized in offshore oil recovery operations through a technique called waterflooding.[94] While none of the aquifers has yet been developed for any

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[90] David E Krantz and others, 'Hydrogeologic Setting and Ground Water Flow Beneath a Section of Indian River Bay, Delaware' (2004) 42 Ground Water—Oceans Issue 1035, 1045

[91] Cohen and others (n 82) 143. The authors note that their estimates could differ from actual volumes by a factor of ±2 should conditions vary from the assumptions used in modeling. ibid 154. The water estimated by Cohen et al to lie beneath the Atlantic continental shelf -- 10^4 km^3 – is a volume equal to the water flowing in all of the world's rivers. Further, the estimated global volume of water in continental shelves -- 3×10^5 km^3 – would equal more than three times the volume of water in the world's surface lakes and rivers, or alternately all of the ground ice and permafrost on the planet. 'How much water is there on, in and above the Earth?' (*US Geological Survey,* 2 December 2016) <https://water.usgs.gov/edu/earthhowmuch.html > accessed 20 January 2018

[92] Post and others (n 74) 75

[93] Mark Person and others, 'Continental-shelf freshwater water resources and improved oil recovery by low-salinity waterflooding' (2016) 100 AAPG Bulletin 1, 2 (Person and others 2016); Tor Haakon Bakken and Lars Erik Mangset*, Sub-marine groundwater for the supply of drinking water. A review of the hydro-geological potential and its technical and economical feasibility* (European Geosciences Union General Assembly 2010); Cohen and others (n 82) 154; Bakken, Ruden and Mangset (n 77) 1015

[94] Person and others 2016 (n 102) 1. According to Person and others, low salinity water, which can be produced through desalination processes on offshore platforms, can improve petroleum

agricultural, industrial or domestic use, technology that has been used for offshore hydrocarbon exploitation could logically be transferred to this new purpose.[95]

Due to the fact that they lie under continental shelves and continental slopes[96], offshore aquifers are expected to be found exclusively in territorial seas and the continental shelves within national jurisdictions, as those terms are utilized in the UN Convention on the Law of the Sea (LOSC)[97]. While none of the aquifers identified thus far straddles the maritime boundaries of two or more nations, the ubiquitous presence of these aquifers suggests strongly that transboundary reserves will be discovered.

1.2.3. Methane hydrates

Freshwater can also be found in marine environments in the form of crystalline structures, called clathrates[98], that consist of a lattice composed of frozen freshwater whose spaces are filled with gas.[99] The spaces inside of clathrates generally host hydrocarbons such as methane, carbon dioxide, ethane, propane, and butane.[100] As a result of dynamic chemical interaction with the surrounding water during formation of the clathrate[101], the gas molecules help to precipitate

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recovery by fourteen percent. According to their calculations, use of horizontal drilling techniques can lead to a productive volume of 19,200 m3/day (120,764 bbl/day) and extend the productive life of offshore aquifers to thirty years.

[95] Bakken and Mangset (n 102); Bakken, Ruden and Mangset (n 67) 1020

[96] Bakken, Ruden and Mangset (n 77) 1016

[97] LOSC (n 5) art 3, 57 For a thorough treatment of UNCLOS, see Arnd Bernaerts, *Bernaerts' guide to the 1982 United Nations Convention on the Law of the Sea including the text of the UN Convention and Final Act* (Fairplay Publications Ltd. 1988).

[98] Volker Krey and others, 'Gas hydrates: entrance to a methane age or climate threat?' (2009) 4 Environmental Research Letters 2; *Energy Resource Potential of Methane Hydrate (National Energy Technology Laboratory, US Department of Energy 2011)* 8

[99] Ehrlich Desa, 'Submarine Methane Hydrates -- Potential Fuel Resource of the 21st Century' (2001) 5 Proceedings of AP Akademi of Sciences 101, 102; Carolyn A Koh, 'Towards a Fundamental Understanding of Natural Gas Hydrates' (2002) 31 Chemical Society Reviews 157; *Preliminary Evaluation of In-Place Gas Hydrate Resources: Gulf of Mexico Outer Continental Shelf* (Minerals Management Service, US Department of the Interior 2008) 1

[100] A Demirbas, 'Methane from Gas Hydrates in the Black Sea' (2010) 32 Energy Sources, Part A 165

[101] M Ben Clennell, 'Formation of natural gas hydrates in marine sediments 1. Conceptual model of gas hydrate growth conditioned by host sediment properties' (1999) 104 Journal of

and serve to strengthen the crystalline structure.[102] In fact, in order for the clathrate to remain stable, at least seventy percent of the spaces within the frozen freshwater lattice must contain other molecules, and normally approximately ninety-five percent of the spaces must be so occupied. [103] Methane is the simplest and smallest hydrocarbon: one carbon atom combines with four hydrogen atoms to make CH_4 [104]. As a result, methane hydrates are the most common form of clathrate,[105] since the smaller size of the methane molecules allows them to interact more easily with the surrounding seawater and fit more comfortably in the hydrate lattice structure[106]. Methane hydrates exist in only a narrow range of low temperatures (between -10 and +10°C) and high to moderate pressure (between 1 and 500 bar)[107] that is called the gas hydrate stability zone (GHSZ).[108]

Methane hydrates are relatively dynamic structures. The methane seeps through the seabed sediment into the ocean, where it reacts with seawater, causing the seawater to freeze into freshwater geometric clathrate structures that house the methane.[109] Gradually the methane escapes from its crystalline cage into the ocean where microbes feed on the hydrocarbon.[110] Due to the nutrient properties of methane, methane hydrates also form the basis of

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Geophysical Research 22,985, 22,986; Roald Hoffman, 'Old Gas, New Gas' (2006) 94 American Scientist 16, 16

[102] David Adam, 'Fire from Ice' (2002) 415 Nature 913; Graham McLaurin and others, 'Antifreezes Act as Catalysts for Methane Hydrate Formation from Ice' (2014) 53 Angewandte Chemie International Edition 10429, 10429

[103] *Frozen Heat: A Global Outlook on Methane Gas Hydrates (Executive Summary)* (United Nations Environment Programme 2014) 8

[104] *Energy Resource Potential of Methane Hydrate* (n 97) 8; Carolyn D Ruppel and John D Kessler, 'The interaction of climate change and methane hydrates' (2017) 55 Reviews of Geophysics 126, 126

[105] Demirbas (n 110) 165

[106] Desa (n 109) 102

[107] RA Dawe and S Thomas, 'A Large Potential Methane Source—Natural Gas Hydrates' (2007) 29 Energy Sources, Part A 217, 218. A bar is approximately equivalent to atmospheric pressure, and the weight of seawater exerts one extra bar for every 10 meters of depth. ibid 122

[108] James P Kennett and others, 'Carbon Isotopic Evidence for Methane Hydrate Instability during Quaternary Interstadials' (2000) 288 Science 128; Desa (n 109) 102; *Energy Resource Potential of Methane Hydrate* (n 114) 9; McLaurin and others (n 111) 10429 ; *Frozen Heat: A Global Outlook on Methane Gas Hydrates (Executive Summary)* (n 113) 9

[109] Demirbas (n 110) 166

[110] *Frozen Heat: A Global Outlook on Methane Gas Hydrates (Executive Summary)* (n 113) 14

ecosystems containing bacteria and invertebrates such as tiny ice-worms[111], as well as larger species such as tubeworms and crabs that have evolved to use the methane as energy[112]. Methane and ethane are the principal components of natural gas[113], and consequently methane hydrates can often be found in proximity to larger methane reserves that can be viewed as natural gas deposits.

Like offshore aquifers, the genesis of methane hydrates dates back thousands of years, when sea levels were much lower than they are now. Plants lived and died on what was then exposed terrain, and soil and silt buried them as rain and wind acted on the surface of the land. As the world warmed and sea levels rose to cover what became continental shelves, bacteria fed on the buried, decomposing plants and produced methane[114], which then rose through the sediment into the GHSZ.[115] Methane is also formed by decomposing marine biota that has been buried in seabed sediment; this gas then rises into the GHSZ where it can react with seawater to form the methane-filled clathrate.[116] Methane hydrates can be found in large free-standing units that are clearly visible on the sea floor, and they can also form as very small, barely detectible units in sedimentary cracks.[117]

Methane hydrates have several notable features. First, the hydrate consists of approximately eighty-five percent frozen freshwater.[118] Second, while undisturbed hydrates are strong enough to support seabed formations, the structure dissociates rapidly when exposed to conditions outside of the narrow

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[111] Koh (n 109) 160; *Frozen Heat: A Global Outlook on Methane Gas Hydrates (Executive Summary)* (n 113) 14

[112] Martha Henriques, 'Why 'flammable ice' could be the future of energy' (*BBC,* 23 November 2018) http://www.bbc.com/future/story/20181119-why-flammable-ice-could-be-the-future-of-energy accessed 24 November 2018

[113] V Mohebbi and others, 'A Mass Transfer Study of Methane and Ethane During Hydrate Formation' (2014) 32 Petroleum Science and Technology 1418

[114] Dawe and Thomas (n 117) 219; Demirbas (n 110) 166

[115] *Frozen Heat: A Global Outlook on Methane Gas Hydrates (Executive Summary)* (n 113) 9

[116] 'Methane hydrate' (World Ocean Review 2014) <https://worldoceanreview.com/en/wor-3/methane-hydrate/formation> accessed 9 December 2018

[117] Desa (n 109) 102

[118] *Frozen Heat: A Global Outlook on Methane Gas Hydrates (Executive Summary)* (n 113) 8

window of low temperature and moderate to high pressure in the GHSZ.[119] Although the US Geological Survey doubts that there is a direct cause and effect[120], some scientists speculate that dissociation of methane hydrates could destabilize large underwater slopes and initiate their collapse, potentially causing catastrophic landslides and sending shock waves and tsunamis through the surrounding area.[121] Third, the high pressure in the GHSZ compresses the methane molecules, so that each unit of methane in a hydrate produces more than one hundred sixty units of methane at normal atmospheric pressure.[122] Lastly, when a hydrate located on the seabed dissociates, the freshwater disperses quickly into the surrounding seawater, causing the freshwater to become salinized rapidly.

Although methane hydrates were produced in laboratory settings in 1810 by Sir Humphrey Davy[123], marine methane hydrates were only discovered in a natural setting in the 1960s[124] and have since been found in the Arctic permafrost and along continental shelves around the world.[125] Because of their requirement for a narrow range of pressure and temperature, methane hydrates are located at minimum depths where the weight of the water exerts sufficient pressure -- about three hundred meters in colder Arctic waters and between five hundred and six hundred meters in warmer sub-tropical waters.[126] According to the US Geological Survey, 'most of the global gas hydrate occurs in the uppermost hundreds of meters of sediments at ocean water depths greater than -500

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[119] ibid 8
[120] 'U.S. Geological Survey Gas Hydrates Project: Submarine Slope Destabilization' *(US Geological Survey)* <https://woodshole.er.usgs.gov/project-pages/hydrates/seafloorstability.html> accessed 21 June 2018
[121] Kennett and others (n 118) 128; Desa (n 109) 111; Adam (n 112) 913; Dawe and Thomas (n 117) 224, 225; *Frozen Heat: A Global Outlook on Methane Gas Hydrates (Executive Summary)* (n 113) 23; Henriques (n 123)
[122] Desa (n 109) 102. Estimates seem to differ. Koh states that a cubic meter of methane in a hydrate with ninety percent of the cages occupied produces one hundred fifty-six cubic meters of methane at standard atmospheric pressure. Koh (n 109) 160. The US Department of Interior uses a ratio of one to one hundred sixty. *Preliminary Evaluation of In-Place Gas Hydrate Resources: Gulf of Mexico Outer Continental Shelf* (n 109) 1. Ruppel and Kessler cite a ratio of one to one hundred eighty. Ruppel and Kessler (n 114) 126
[123] Demirbas (n 110) 166
[124] *Energy Resource Potential of Methane Hydrate* (n 118) 14
[125] Desa (n 109) 102; *Energy Resource Potential of Methane Hydrate* (n 118) 9
[126] Desa (n 109) 103

[meters] and close to continental margins',[127] which places them in the outer continental shelf that will be discussed in Chapter 2. Methane hydrates also exist under the sea floor, but, because temperatures gradually rise with depth, the GHSZ ends between a few hundred and a thousand meters beneath the sea floor.[128] At least ninety-five percent of methane hydrates is located in marine areas, with the remainder in permafrost.[129]

Scientific studies estimate that there is three thousand times more methane in hydrates than is currently in the atmosphere[130], and the volume of methane in hydrates is twice the amount of globally recoverable fossil fuels[131]. As nations look for alternatives sources of energy, these compressed pockets of natural gas have engendered interest.[132] The prospect of developing methane hydrates as an energy source has also raised concerns about their contribution to climate change should the compressed methane in the hydrates be released into the oceanic water column.[133] A recent scientific publication suggests that natural oceanic oxidation and dispersion processes will prevent methane from dissociating hydrates from reaching the ocean surface[134], and Carolyn Ruppel and John Kessler note that there is no evidence of dissociated methane reaching the atmosphere from the seabed.[135] However, should the methane from the hydrates be retrieved and then utilized as an alternative energy source, then that methane will certainly enter the atmosphere through anthropogenic activity. For the first ten years after its emission into the atmosphere, methane is a significantly more powerful atmospheric greenhouse gas than carbon

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[127] 'The U.S. Geological Survey Gas Hydrates Project: Gas Hydrates Primer' (*U.S. Geological Survey*) https://woodshole.er.usgs.gov/project-pages/hydrates/primer.html accessed 21 June 2018

[128] ibid 103; Adam (n 112) 913

[129] Şükrü Mereya and Sotirios Nik. Longinos, 'Does the Mediterranean Sea have potential for producing gas hydrates?' (2018) 55 Journal of Natural Gas Science and Engineering 113, 113

[130] Desa (n 109) 110

[131] Matthew R Walsh and others, 'Preliminary report on the commercial viability of gas production from natural gas hydrates' (2009) 31 Energy Economics 815

[132] Koh (n 109) 160; *Preliminary Evaluation of In-Place Gas Hydrate Resources: Gulf of Mexico Outer Continental Shelf* (n 109) 2; Krey and others (n 108) 2

[133] Ruppel and Kessler (n 114) 132-3 The authors cite to several reports, including IPCC reports.

[134] Katy J Sparrow and others, 'Limited contribution of ancient methane to surface waters of the U.S. Beaufort Sea shelf' (2018) 4 Science Advances 1,1

[135] Ruppel and Kessler (n 114) 134-5;

dioxide, with the impact of methane ranging from forty times[136] to eighty-four times[137] that of carbon dioxide. Thereafter, methane reacts with atmospheric oxygen to form two other greenhouse gases --carbon dioxide and water vapor[138] -- thus adding significantly to the warming cocktail that encircles the earth.

At present, only a few countries such as Canada, China, India, Russia, Japan and the US are researching development of methane hydrates for energy use.[139] Although in May 2017 both China[140] and Japan[141] announced successful production of methane from seabed hydrates, the technology for harvesting them has not yet matured to the point of being commercially or scientifically viable on a large scale[142]. Indeed, even drilling through a hydrate can raise its temperature enough to cause dissociation due to the liquids and cement in the drill pipe.[143] Because of the fragility of the clathrate structure, current speculation is that only methane hydrates buried deep beneath the sea floor would be suitable for harvesting.[144] Although freshwater comprises the largest component of methane hydrates, to date freshwater has been seen as a disposable by-product of hydrate development that must be managed.[145]

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[136] TF Stocker and others (eds), *Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* (Cambridge University Press 2013) 59
[137] Ruppel and Kessler (n 114) 126
[138] *Energy Resource Potential of Methane Hydrate* (n 118) 11
[139] Demirbas (n 110) 168
[140] Megan Geuss, 'Japan, China have extracted methane hydrate from the seafloor' (*arstechnica*, 22 May 2017) <https://arstechnica.com/science/2017/05/energy-dense-methane-hydrate-extracted-by-japanese-chinese-researchers/> accessed 20 January 2018
[141] 'Japan reports successful gas output test from methane hydrate' (*Reuters,* 8 May 2017) <https://www.reuters.com/article/japan-methane-hydrate/japan-reports-successful-gas-output-test-from-methane-hydrate-idUSL4N1IA35A> accessed 20 January 2018; Henriques (n 123)
[142] Walsh and others (n 141) 819; *Energy Resource Potential of Methane Hydrate* (n 118) 9; *Frozen Heat: A Global Outlook on Methane Gas Hydrates (Executive Summary)* (n 113) 23
[143] Dawe and Thomas (n 117) 225
[144] *Frozen Heat: A Global Outlook on Methane Gas Hydrates (Executive Summary)* (n 113) 22
[145] Walsh and others (n 141) 821; *Frozen Heat: A Global Outlook on Methane Gas Hydrates (Executive Summary)* (n 113) 23; Roy Andrew Partain, 'Avoiding Epimetheus: Planning Ahead for the Commercial Development of Offshore Methane Hydrates' (2015) 15 Sustainable Development Law & Policy 16, 19

In analyzing the legal issues that would accompany development of freshwater resources from methane hydrates, this thesis will assume that technology will someday permit safe, efficient and economical extraction of freshwater from the hydrates, allowing methane hydrates to become a viable alternative source of freshwater. Since the hydrates, like offshore aquifers, have been found only within the continental shelves, they will most likely be governed by legal regimes for the continental shelves. From a legal standpoint, methane hydrates should represent a hybrid resource, for they are composed of both water and hydrocarbon, with each resource potentially having its own governance regime. One could even argue that they should be classified as freshwater resources since the vast majority of their chemical structure is composed of frozen freshwater. Thus far, though, nations have viewed them only as hydrocarbon resources, and all of the research focuses on using the methane as an alternative source of energy. However, someday freshwater may become more valuable than hydrocarbons, and technology may facilitate recovering freshwater from hydrates without suffering saline contamination and without releasing methane into the atmosphere. In that future era, water governance principles may trump hydrocarbon governance principles, and freshwater will indeed have become Blue Gold[146]. For the time being, though, this thesis will assume that methane hydrates will continue to be governed as hydrocarbons, although their hybrid nature may lead to inclusion of water law principles in future governance regimes.

1.2.4 Economic considerations

Investment of financial resources for development of offshore natural resources only makes economic sense when there is an active global market for those resources. The active market for offshore hydrocarbons is a compelling example. In such cases, the ultimate profits justify the initial outlay of financial capital. While there are examples of water being transferred in bulk both

[146] Maude Barlow and Tony Clarke, '*Blue Gold: The Fight to Stop the Corporate Theft of the World's Water*' (The New Press 2002)

domestically and across international borders[147], bulk freshwater is not yet viewed as a globally tradable fungible commodity like other natural resources such as hydrocarbons and minerals. As a result, a global market and financial infrastructure that would support extensive and expensive exploitation and distribution does not yet exist for freshwater, much less for offshore water.

The techniques for extracting water from offshore aquifers may be similar to the techniques already utilized for hydrocarbons, but currently the price of water will not provide the economic returns on investment that generally must accompany a sizable infusion of capital. Financial capital of this magnitude will only be released if there is an economic justification and if a return on the investment would be achieved by selling water as a commodity. For a variety of reasons, water has not been priced on the global market in accordance with its full economic, social, cultural and environmental value to humans and ecosystems.[148] The basic rules of economic theory provide that prices of products rise in accordance with their value and scarcity.[149] One can assume that public and private investors will only redirect precious financial capital if adequate freshwater on land has become dangerously scarce through contamination, over-extraction or both. If the trends cited in Chapter 1.2.1 continue, then absolute water scarcity will arrive in the next few decades, and financial resources will be directed to securing adequate supplies of freshwater from unconventional sources.

Unfortunately, the capital costs in the water sector are exceptionally high. According to Michael Hanneman, in the US 'the ratio of capital investment to revenues in the water industry is double that in natural gas, and 70% higher

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147 For a discussion of the application of international trade law on bulk freshwater transfers, see Edith Brown Weiss, *International Law for a Water-Scarce World* (Koninklijke Brill 2013) 251-76.

148 Alexis J Morgan and Stuart Orr, *The Value of Water: A framework for understanding water valuation, risk and stewardship* (WWF and IFC 2015) 1

149 *Water: A Shared Responsibility* (United Nations Educational, Scientific and Cultural Organization (UNESCO) and Berghahn Books 2006) 401; Evan Osborne, *Reasonably Simple Economics: Why the World Works the Way It Does* (Springer 2013) 45

than in electricity or telecommunications.'[150] He gives multiple reasons: the infrastructure is immovable, long-lived and unusable for any other purpose, and water is bulky and difficult to transport.[151] In addition, in a free market system there are competing priorities for scarce financial resources, which create political and economic hurdles that must be overcome in order for provision of freshwater to receive cash outlays.[152] In the mid-1990s the sources of financing for water infrastructure were estimated to be, on average, 65-70% from the domestic public sector, 5% from the domestic private sector, 10-15% from international donors, and 10-15% from international private companies.[153] The low investment rates from the private sector result from its preference for energy, transport and telecommunications.[154] However, the prior practice of viewing freshwater as a public service not requiring full cost recovery from users is changing[155], which may result in more private sector investment being directed to the water sector.

As Michael Hanneman notes, water is both a private and a public good – it is a private good when allocated and utilized for domestic, industrial or agricultural use, and it is a public good when left in situ for navigational, recreational or environmental use.[156] The opportunity for profits from private goods acts as a magnet for capital flows, and there is at least one example of a large and active market for freshwater as a private good. Due to concerns about contamination of drinking water, the bottled water industry has been growing steadily. In 2017 the market for bottled water grew to US$238.5 billion, up nine percent

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[150] WM Hanemann, 'The economic conception of water' in *Water Crisis: Myth or Reality Marcelino Botin Water Forum 2004* (Taylor and Francis 2006) 74
[151] ibid
[152] Frank A Ward and Ari Michelsen, 'The Economic Value of Water in Agriculture: Concepts and Policy Applications' (2002) 4 Water Policy 423, 425
[153] James Winpenny, *Financing Water for All: Report of the World Panel on Financing Water Infrastructure* (3rd World Water Forum, World Water Council and Global Water Partnership 2003) 6
[154] ibid 13
[155] *Water: A Shared Responsibility* (n 159) 414
[156] Hanemann (n 160) 71

from the prior year.[157] Nearly four hundred forty billion liters were sold, due in large part to consumers in the Asia Pacific region who were responsible for forty-two percent of the global market.[158] Added ingredients such as minerals, oxygen, vitamins and flavors make the product even more attractive to health-conscious consumers, and sales of bottled water are forecast to increase by ten percent annually through 2021. Should offshore freshwater be found to have beneficial components such as minerals that are essential for health, the prospect of tapping such a huge commercial market may encourage private investment.

Meanwhile, the costs of offshore drilling are declining. To use offshore hydrocarbon costs as a guideline, the cost of drilling an offshore hydrocarbon well has ranged up to US$ 100 million and required months to construct.[159] A recent drilling technique called tapping, made possible by new underwater pump technology, reduces the cost by allowing one floating platform to serve multiple drilling sites that are up to sixty miles from the platform.[160] Using this tapping technique can lower the cost of developing an offshore petroleum reserve to US$ 35-40 per barrel.[161] Using the petroleum standard of forty-two gallons per barrel of petroleum, the 2017 global market for bottled water amounted to 2.75 billion barrels. At a cost of US$ 40 per barrel, using offshore aquifers for the entire 2017 global market for bottled water would have cost US$ 110 billion, less than half of the sales revenue. Other financially attractive uses may be found for offshore freshwater, but this illustration alone shows that commercial possibilities may cause the beginning of offshore freshwater development to be measured in years instead of decades.

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[157] The Business Research Company, 'The Global Bottled Water Market: Expert Insights & Statistics' (*Market Research Blog*, 28 February 2018) <https://blog.marketresearch.com/the-global-bottled-water-market-expert-insights-statistics> accessed 13 August 2018

[158] ibid

[159] Ed Crooks, 'Offshore rig operators reel from oil price rout' (*Financial Times*, 24 April 2016) <https://www.ft.com/content/e346a5ca-0a0f-11e6-9456-444ab5211a2f> accessed 13 August 2018

[160] Kevin Crowley, "Deep-Water Drilling Is Back' (*Bloomberg Businessweek*, 21 June 2018) https://www.bloomberg.com/news/articles/2018-06-21/chevron-deep-water-tentacles-show-big-oil-rivaling-shale-in-gulf accessed 13 August 2018

[161] ibid

1.2.5 Shoreline regime change

Currently, global treaties change legal regimes at the shoreline, with LOSC applying seaward of the shoreline and other UN conventions applying landward. Article 5 of LOSC provides that 'the normal baseline for measuring the breadth of the territorial sea is the low-water line along the coast',[162] thus clarifying that the scope of LOSC begins at the low-tide line. Similarly, Article 57 states that measurement of the Exclusive Economic Zone also starts at the baseline of the territorial sea.[163] As Chapter 4 illustrates, the offshore hydrocarbon industry, which concerns a resource with properties similar to those of freshwater, likewise accepts that the law of the sea applies to reserves found beyond the low-tide line.

As will be discussed in greater detail in Chapter 3, two global treaties address land-based freshwater – the UN Convention on the Law of Non-navigational Uses of International Watercourses (UN Watercourses Convention)[164] and the UN Economic Commission of Europe Convention on the Protection and Use of Transboundary Watercourses and International Lakes (UNECE Water Convention)[165]. The UNECE Water Convention clearly limits its scope to land-based freshwater, stating that

> wherever transboundary waters flow directly into the sea, these transboundary waters end at a straight line across their respective mouths between points on the low-water line of their banks.[166]

The UN Watercourses Convention similarly limits its scope to land-based water systems but takes a more circuitous route to the same destination as the UNECE

[162] LOSC (n 5) art 5
[163] LOSC (n 5) art 57
[164] UN Watercourses Convention (n 16)
[165] Convention on the Protection and Use of Transboundary Watercourses and International Lakes (adopted 17 March 1992, entered into force 6 October 1996) 1936 UNTS 269; ILM 1312 (UNECE Water Convention)
[166] ibid art 1.1

Water Convention. In the UN Watercourses Convention, a watercourse is simply defined as 'a system of surface waters and groundwaters constituting by virtue of their physical relationship a unitary whole and normally flowing into a common terminus'[167], but the meaning of 'common terminus' is not clarified in the treaty[168]. In fact, the issue of the geographic scope of the treaty was considered to be so complex and contentious that the UN International Law Commission (UNILC) decided in 1976 to table the topic until a later time and instead address other issues.[169] A review of all of the reports of the special rapporteurs for the UN Watercourses Convention from 1976 through 1994 sheds little light on the intended definition of 'common terminus'. However, the UNILC recognized in 1976 that the law of international watercourses would be separate from the law of the sea, although the two legal regimes could follow similar patterns in 'transcend[ing] the interests contained within national frontiers' and in ensuring that 'the world would remain a world of sovereign States'.[170] In his first report in 1979, Special Rapporteur Stephen Schwebel explained that 'one of the principal physical characteristics of water is that it drains to the sea or other terminus within its own distinct watershed',[171] which supports an inference that the law of international watercourses ends at the shoreline.

Ultimately, the drafters of the UN Watercourses Convention utilized scoping verbiage nearly identical to that found in the 1966 Helsinki Rules, which had achieved wide acceptance.[172] The Helsinki Rules defined international rivers as

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[167] UN Watercourses Convention (n 16) art 2(a)

[168] The commentary to the final draft of Article 2 of the UN Watercourses Convention did not advance a definition of 'common terminus', although it did note that some states had requested that the term be removed, arguing that it was 'hydrologically wrong and misleading'. ILC, 'Report of the International Law Commission on the work of its forty-sixth session' (2 May-22 July 1994) UN Doc A/49/10, para 222 (ILC Report of forty-sixth session)

[169] ILC, 'Report of the International Law Commission on the work of its twenty-eighth session' (3 May-23 July 1976) UN Doc A/31/10, para 164

[170] ibid para 163

[171] ILC, 'First report on the law of the non-navigational uses of international watercourses, by Mr. Stephen M. Schwebel, Special Rapporteur' (1979) UN Doc A/CN.4/320, para 107

[172] ibid para 34; ILC, First report on the law of the non-navigational uses of international watercourses, by Mr. Jens Evensen, Special Rapporteur (1983) UN Doc A/CN.4/367, para 69. The commentary to the final draft of Article 2 of the UN Watercourses Convention did not

'a system of waters, including surface and underground waters, flowing into a common terminus', indicating in the comments that a common terminus is 'the principal river, stream or lake or other common terminus'.[173] Thus, the UN Watercourses Convention mirrored the Helsinki Rules in viewing a 'common terminus' as a land-based demarcation representing the limits of application of the treaty.

The end result is that two separate legal regimes will apply to freshwater – one regime for land-based freshwater and a different regime for offshore freshwater. Even scientific studies follow this pattern of separation,[174] even though such a clear demarcation is not scientifically sound, since some coastal freshwater aquifers have hydraulic links to land-based freshwater sources[175]. One can question the logic of having two separate legal regimes for one integrated resource, and some treaties have adopted integrated coastal zone management (ICZM) of all coastal activities and resources. Under those regimes, offshore aquifers connected to land-based aquifers could be managed as a single reservoir. In the future, the artificial segregation of legal regimes at the shoreline may be replaced globally by a more integrated legal structure to reflect the reality of hydraulic and other systems, but for now the line is clearly draw in the sand.

1.3 METHODOLOGICAL APPROACH

This thesis builds on the author's 2010 LLM thesis on fossil aquifers, on her 2016 monograph on governance of offshore aquifers, and on her other

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provide a definition of 'common terminus', although it did note that some states had requested that the term be removed, arguing that it was 'hydrologically wrong and misleading'. ILC Report of forty-sixth session (n 179) para 222

[173] ILA, 'Helsinki Rules on the Uses of Waters of International Rivers', International Law Association Report of the Fifty-second Conference (Helsinki 1966) (International Law Association, London 1967) art II

[174] Andrew C Knight, Adrian D Werner and Leanne K Morgan, 'The onshore influence of offshore fresh groundwater' (2018) 561 Journal of Hydrology 724, 724

[175] ibid

publications and presentations that examine the role of offshore freshwater in solving the world's looming freshwater shortages.

Predicting the governance regime for an untapped repository of a vital resource necessarily requires careful consideration of relevant legal principles, socio-cultural influences, scientific elements and economic pressures that could have an influence on the final regime structure. This thesis therefore takes an interdisciplinary approach to its analyses, while exploring three distinct legal regimes – the law governing seabed natural resources, legal principles for transboundary land-based freshwater, and governing structures for offshore transboundary oil and gas development. In addition, the thesis will address legal principles and regimes that seek to protect the environment and biodiversity. Finally, the thesis will close by describing the likely governing structures should offshore freshwater be developed under current international law principles as well as emerging philosophies that might affect distribution of an untapped but vital resource.

From a doctrinal point of view, the thesis examines both primary and secondary sources of law, including applicable case law, bilateral and multilateral treaties, customary law, UN-sponsored work, and publications by legal scholars in all of the above-mentioned subject areas. Current governance structures will grant sovereignty to domestic offshore freshwater supplies, but governance of transboundary resources is not clear. Therefore, particular attention was given to legal principles for shared natural resources. In this regard, existing treaties for offshore hydrocarbons, minerals and other non-living natural resources provided rich insights into the wide range of governance structures that states have adopted. By comparing these structures, the author was able to discern and distinguish the very few common elements and the wide variety of possible solutions to sharing resources.

Empirically, no fieldwork could be undertaken since offshore freshwater resources have not yet been developed. In fact, researchers struggle to secure

enough funding to support simple seismic testing designed to confirm locations of aquifers. In place of fieldwork, the author has communicated with scientists from around the world about both aquifers and methane hydrates, and she presented her research on governance to marine hydrogeologists at a May 2017 conference organized by the International Ocean Discovery Program and the International Continental Scientific Drilling Program. To research legal concepts, she performed a thorough desktop literature review and conducted informal interviews with practitioners and scholars who specialize in the law of the sea, international water law, offshore hydrocarbon law and emerging legal philosophies regarding ownership and allocation of natural resources.

Given word count limitations, this thesis did not explore several related topics that deserve future attention. Since international law currently recognizes and protects sovereign interests in natural resources, some resource-scarce states and their populations do not have actionable rights to an adequate supply of critical natural resources, such as freshwater, that are located outside their jurisdictions. Research into post-sovereign governance structures supporting a global commons and distributive equity for offshore freshwater would be interesting and perhaps helpful to disadvantaged states. Further research should also be done on the historical connections, socio-economic factors and performance under existing bilateral treaties that address offshore natural resources in order to understand what factors may influence states when they begin to negotiate rights to transboundary offshore freshwater resources. Finally, more research should be done on domestic laws of those states where offshore aquifers have been identified in order to determine the similarities and differences in how this additional resource might be governed.

1.4 STRUCTURE

In response to its central research questions, this thesis has attempted to discover which legal principles will apply to offshore freshwater resources and to predict how those resources will be governed under current governing structures. As explained above, the legal regime governing development of offshore freshwater will be similar to that for other natural resources in that rights and obligations of both access and distribution must be considered. Most treaties cover only access and ownership of natural resources, with distribution left largely to the discretion of the parties possessing those rights. A governance regime for offshore freshwater has not yet been determined, so the rights and obligations regarding access to and ownership of the resource await detailed discussions and agreed principles. However, at least three distinct legal regimes can provide either ruling law or analogous precedents: the law governing seabed natural resources, legal principles for transboundary land-based freshwater and governing structures for offshore oil and gas development.

As an introduction to the topic of the thesis and in order to orient the reader, Chapter 1 has described the looming water crisis that will initiate a search for alternative freshwater reserves, has provided an abbreviated scientific explanation of the origins and properties of offshore aquifers and offshore methane hydrates and has explored economic factors and the change in legal regimes at the shoreline.

Chapter 2 begins by explaining how the law of the sea, as codified in LOSC, assigns to coastal states sovereignty and sovereign rights over seabed natural resources. Offshore freshwater is expected to be found exclusively within the continental shelf areas, with aquifers located closer to land than methane hydrates due to the circumstances of their separate formations. It is doubtful whether either form of offshore freshwater will lie within the Area, although methane hydrates could straddle the OCS and the Area and could be found in the Area if a continental shelf extends beyond three hundred fifty nautical miles.

Given that offshore freshwater resources lie within continental shelves, LOSC will entitle coastal states to claim the benefits of the resource when reserves are located within their national jurisdictions. LOSC provides no guidance on ownership of transboundary natural resources, but does indicate that maritime boundaries must be equitably drawn. The number of LOSC governance zones produces a variety of transboundary possibilities, so the permutations of situations involving shared resources are presented and explained. Chapter 2 also discusses obligations to protect the marine environment that are present in LOSC, in the Regional Seas Programme, in the Convention on Biological Diversity and elsewhere.

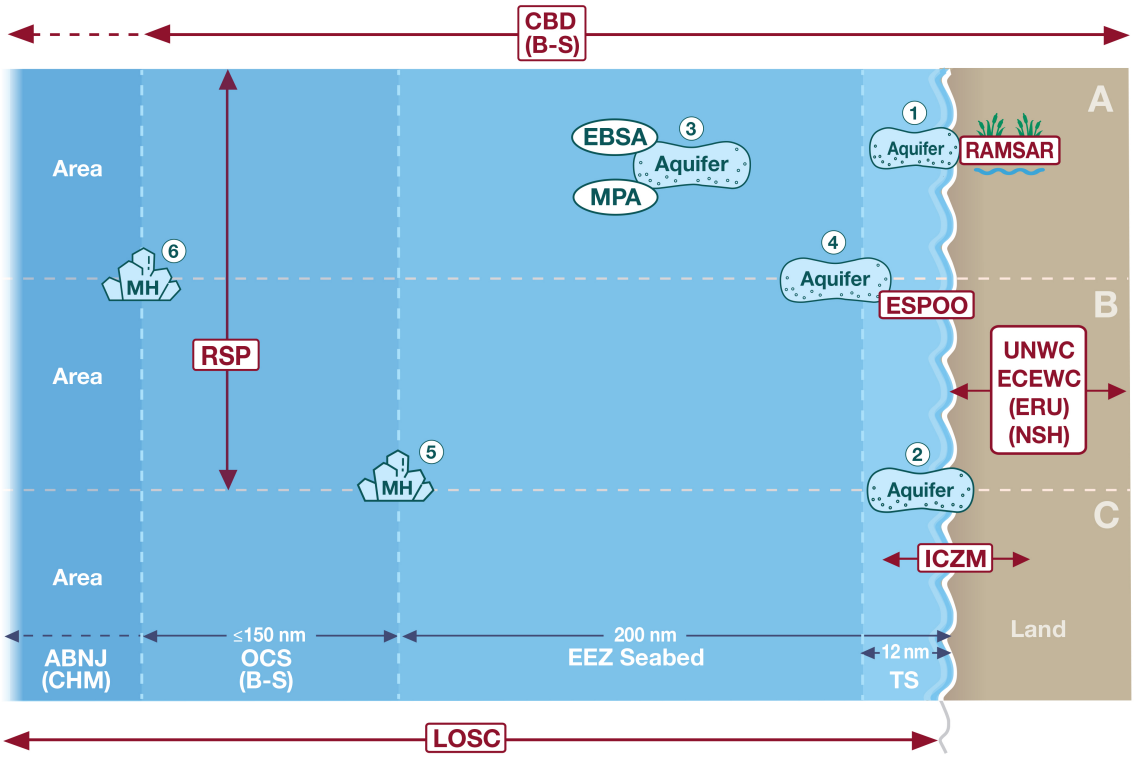
While its location may be in the marine environment, the intrinsic nature of offshore freshwater is still the uniquely vital resource of freshwater, and certain of the primary legal principles governing land-based freshwater may be influential if not controlling. Chapter 3 therefore delves into international law principles that apply to land-based freshwater, tracing the path from navigational uses of shared watercourses to non-navigational uses of shared freshwater resources. As legal principles for non-navigational uses evolved, the primacy of the principle of protection of the resource from significant harm ceded to equitable and reasonable utilization of shared resources, a transition that favored commercial development. While this body of law has historically been more concerned with access and ownership of freshwater than with distribution, the principle of equitable and reasonable utilization could be viewed as mandating fair distribution of a critical resource among parties sharing a transboundary resource. Although distribution of freshwater under international water law is limited to the states having sovereign rights to the resource, those sovereign rights are being tempered by the principle of a human right to water, which is discussed in Chapter 5.

Offshore oil and gas reservoirs have characteristics similar to aquifers, and methane hydrates are classified as hydrocarbon resources in spite of the relatively small percentage of hydrocarbon they contain. Thus, Chapter 4

presents the legal structures that have evolved for offshore hydrocarbon as they might influence or impact governance of offshore freshwater. Given that LOSC and customary law clearly grant sovereign rights to natural resources in areas within national jurisdiction, much of offshore hydrocarbon law developed to resolve conflicts and achieve efficiencies where transboundary resources are involved. When directed by the International Court of Justice to find an equitable solution to transboundary oil and gas fields, the hydrocarbon industry followed the international water law principle of equitable and reasonable utilization in adopting unitization and joint development agreements. Chapter 4 thus describes how states achieved equitable solutions regarding transboundary offshore natural resources, minerals and hydrocarbons by analyzing primary legal sources, scholarly publications and applicable bi-lateral treaties. Since development of offshore freshwater may use techniques similar to those utilized by the hydrocarbon industry, Chapter 4 also outlines environmental hazards from offshore drilling and summarizes environmental protection obligations that have arisen.

In closing, Chapter 5 summarizes the preceding chapters by providing a concise description of the sovereign rights and governance structures that will apply to both domestic and transboundary offshore freshwater. Legal regimes and principles that would apply to the six hypothetical scenarios presented in Figure 1 below will be analyzed in the context of development of offshore freshwater resources. In addition, the chapter presents a summary of emerging trends that may influence the distribution of offshore freshwater when the resource is developed at some point in the future, such as the human right to water, benefit-sharing, freshwater as a global commons and post-sovereign governance of natural resources.

Figure 1


CBD
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ESPOO
6
MH
RSP
UNWC
ECEWC
(ERU)
(NSH)
5
MH
2
Aquifer
ICZM
Land
ABNJ
(CHM)
≤150 nm
OCS
(B-S)
200 nm
EEZ Seabed
12 nm
TS
LOSC

CHAPTER 2

LEGAL PRINCIPLES GOVERNING SEABED NATURAL RESOURCES

INTRODUCTION

Any discussion regarding exploitation of potentially vast quantities of fresh to slightly brackish water that lie within continental shelves will necessarily involve questions of access, ownership and control on the part of coastal states. The legal principles governing seabed natural resources provide insights into possible governance regimes for any newly discovered and potentially valuable natural resources such as offshore freshwater reserves. In the event that development of offshore freshwater resources should be deemed to be technologically feasible and, more decisively, economically viable, then one can assume that suitable land-based freshwater resources will have become scarce enough that the value and thus the price of freshwater will have risen above its current level. Given that in many cases land-based aquifers have been depleted in a race to the bottom[176] that mirrors a tragedy of the commons[177], one would hope that more sensible management practices would be adopted for the last large planetary reservoir of freshwater. Under the currently accepted system of governance, nations claim sole sovereignty over natural resources that are found within their terrestrial and maritime jurisdictions, and questions of ownership and potential conflicts generally arise only when a resource straddles a national border and is therefore shared by two or more states. At the same time, as concerns about the impact of offshore development rise, environmental protection obligations are placing increasing limitations on sovereign rights to explore and exploit seabed resources, even within national jurisdictions.

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[176] For a description of depletion of fossil aquifers, see Renee Martin-Nagle, 'Fossil Aquifers: A Common Heritage of Mankind' (2011) 2 Journal of Energy and Environmental Law 39, 49-51.
[177] Garrett Hardin introduced the theory of the tragedy of the commons, whereby unrestricted use of a natural resource leads to its depletion and ultimate destruction. Garrett Hardin, 'The Tragedy of the Commons' (1968) 162 Science 1243

Against this background, Chapter 2 will delve into the current status of access, ownership, control and regulation of natural resources lying in the seabed. The 1945 Truman Proclamation[178], the 1958 Convention on the Continental Shelf[179] and the 1982 United Nations Convention on the Law of the Sea (LOSC)[180] all served to extend the breadth and scope of state sovereignty over offshore natural resources. With its one hundred sixty-eight parties[181], LOSC has achieved almost universal acceptance and divides the ocean into maritime sectors based on distance from shore, with different legal regimes applying in each sector. Since LOSC is the primary multilateral treaty governing the oceans, this chapter will begin by describing the LOSC sectors and the sovereign rights that attach to each of them. The greater number of sovereign nations since World War II has created more boundaries and therefore more transboundary resources, and the chapter will therefore also describe the various types of transboundary resources that might exist under LOSC and its zones.

Sovereign rights are not absolute and are tempered by requirements to take steps to protect the natural environment. LOSC contains certain of those requirements and other legal support is provided by customary law, judicial decisions and regional treaties and by another global, multilateral treaty -- the

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[178] Presidential Proclamation 2667, 28 September 1945: 'Natural Resources of the Subsoil and Sea Bed of the Continental Shelf,' *10 Federal Register* 12303 (1945), 59 Stat 884 On the same day, President Truman also signed a proclamation 'establish[ing] conservation zones in those areas of the high seas contiguous to the coasts of the United States'. Presidential Proclamation 2668, 28 September 1945: 'Coastal Fisheries in Certain Areas of the High Seas,' *10 Federal Register* 12304 (1945), 59 Stat. 885

[179] Convention on the Continental Shelf (adopted 29 April 1958, entered into force 10 June 1964) 499 UNTS 311, TIAS No. 5578, 15 UST 471 The 1958 Geneva Convention (known as UNCLOS I) also produced four other agreements that eventually came into effect as precursors of the UN Convention on the Law of the Sea: Convention on the Territorial Sea and the Contiguous Zone (adopted 29 April 1958, entered into force 10 September 1964) 516 UNTS 205; Convention on the High Seas (adopted 29 April 1958, entered into force 30 September 1962) 450 UNTS 11; Convention on Fishing and Conservation of the Living Resources of the High Seas (adopted 29 April 1958, entered into force 20 March 1966) 559 UNTS 285; Optional Protocol of Signature concerning the Compulsory Settlement of Disputes (adopted 29 April 1958, entered into force 3 September 1962) 450 UNTS 169

[180] United Nations Convention on the Law of the Sea (adopted 10 December 1982, entered into force 16 November 1994) 1833 UNTS 897 (LOSC)

[181] 'United Nations Convention on the Law of the Sea' (*United Nations Treaty Collection*) <https://treaties.un.org/pages/ViewDetailsIII.aspx?src=TREATY&mtdsg_no=XXI-6&chapter=21&Temp=mtdsg3&lang=en> accessed 4 December 2018 Notably, the US is not a party to LOSC.

Convention on Biological Diversity (CBD)[182]. The second section of this chapter will highlight state obligations with respect to environmental protection and sustainability.

2.1 The Law of the Sea

2.1.1 Maritime zones under national jurisdiction

LOSC preserved the differentiation between sovereignty and sovereign rights that appeared in the 1958 Geneva Conventions on the Law of the Sea, but LOSC expanded the number of zones of national jurisdiction from three to four: the territorial sea, the contiguous zone, the Exclusive Economic Zone (EEZ) and its underlying seabed (EEZ Seabed), and the outer continental shelf (OCS). Each zone brings slightly different rights, and offshore freshwater will be subject to those LOSC party rights.

LOSC recognizes full state sovereignty over the superjacent waters, the airspace and the seabed and subsoil of the twelve-mile territorial sea, which is measured from a low-water baseline[183]; the territorial sea is treated as simply an extension of terrestrial territory.[184] Rights to resources in the territorial seas have not engendered much controversy, since recognition of sovereignty over a band of coastal water predates LOSC by centuries and is thus firmly established under customary law.[185] Subject to obligations to ensure the right of innocent passage[186] and to protect the environment[187], LOSC recognizes the jurisdictional right of states to develop, utilize, allocate and sell seabed resources within their territorial sea.

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[182] Convention on Biological Diversity (adopted 14 June 1992, entered into force 29 December 1993) 1760 UNTS 79 (CBD)
[183] LOSC (n 180) arts 3, 5
[184] ibid art 2
[185] AL Morgan, 'The New Law of the Sea: Rethinking the Implications for Sovereign Jurisdiction and Freedom of Action' (1996) 27 Ocean Development & International Law 5, 7
[186] LOSC (n 180) art 17
[187] ibid part XII

However, by providing that a state has 'the right to establish the breadth of its territorial sea up to a limit not exceeding 12 nautical miles'[188], LOSC does not automatically grant a twelve-mile territorial sea to coastal states, but rather sets twelve miles as the ultimate limit, allowing a state to claim less than twelve miles if it so chooses[189]. Occasionally states have opposite coasts that are less than twenty-four nautical miles apart, resulting in a territorial sea less than twelve nautical miles for each of them. States may also choose to claim less than twelve nautical miles in order to protect a shipping corridor through narrow straits and in order to avoid conflict.[190] In some cases states maintain that their territorial sea extends beyond twelve miles[191], but the vast majority of states support a territorial sea of twelve nautical miles[192]. The contiguous zone where a state can prevent or punish 'infringement of its customs, fiscal, immigration or sanitary laws and regulations' was retained from the 1958 Convention on the Territorial Sea and the Contiguous Zone[193] and extends for another twelve miles beyond the twelve-mile boundary of the territorial sea.[194]

The next maritime zone beyond the territorial sea is the Exclusive Economic Zone (EEZ), which begins at the outer limit of the territorial sea[195] and extends two hundred miles from the baseline of the territorial sea.[196] Part V of LOSC contains the provisions that govern the EEZ, but EEZ rights are considered to be

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188 ibid art 3

189 Lawrence Juda, 'The exclusive economic zone: Compatibility of national claims and the UN Convention on the Law of the Sea' (1986) 16 Ocean Development & International Law 1, 9 Togo claims only a thirty-mile territorial sea. Clive Schofield, 'Securing the resources of the Deep: Dividing and Governing the Extended Continental Shelf' (2015) 33 Berkeley Journal of International Law 274, 277 fn 17

190 John E Noyes, 'The Territorial Sea and Contiguous Zone' in Donald R Rothwell and others (eds), *The Oxford Handbook of the Law of the Sea* (Oxford University Press 2015) (Noyes 2015) 94

191 The Philippines, Togo, Benin, Ecuador, El Salvador, Somalia and Peru all assert that their territorial seas have a breadth of two hundred miles. Noyes (n 201) 94, fn 18; Schofield (n 200) 277 fn 17

192 Noyes 2015 (n 190) 94

193 Convention on the Territorial Sea and the Contiguous Zone (n 190) art 24

194 LOSC (n 180) art 33(1)(a) Since the designation of a contiguous zone has little additional impact on ownership or development of seabed resources, the contiguous zone will not be discussed further.

195 ibid art 55

196 ibid art 57

optional: a state must make a claim to those rights in order to preserve them.[197] Although Article 56 of LOSC grants to coastal states sovereign rights in the EEZ Seabed of the continental shelf, the EEZ regime applies primarily to activities in the water column. Article 56 clarifies that Part VI of LOSC, which governs activities in the continental shelf, also directs how states exercise their rights in the EEZ Seabed[198], thereby creating a separation between the regime governing the EEZ and the regime governing the EEZ Seabed.[199] In fact, in the *Bay of Bengal Case* the International Tribunal for the Law of the Sea (ITLOS) ruled that in one part of the Bay of Bengal two states have separate but concurrent rights: Myanmar has rights to the EEZ water column and at the same time Bangladesh has rights to the EEZ Seabed.[200] Article 60 of LOSC grants to the coastal state exclusive jurisdiction over installations and structures in its EEZ[201], and that provision would seem to grant to Myanmar the right to regulate development-related installations and structures that Bangladesh may want to place in its continental shelf seabed. The state holding rights to the EEZ Seabed and/or the continental shelf would be the controlling sovereign entity for offshore freshwater resources and would determine the regulatory process for development.

Part VI of LOSC further confirms the separate regimes for the EEZ water column and the continental shelf seabed by defining the continental shelf to include the seabed and subsoil but not the water column.[202] Pursuant to Pat VI, a state has sovereign rights to explore and exploit the 'mineral and other non-living

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[197] James Crawford, *Brownlie's Principles of Public International Law* (8th edn, Oxford University Press 2012) 277; Yoshifumi Tanaka, *The International Law of the Sea* (Cambridge University Press 2012) (Tanaka 2012) 125

[198] LOSC (n 180) art 56(3) Although Part V addressing the EEZ is much broader in granting sovereign rights to natural resources found in the water column as well as the seabed and subsoil, Part VI, which addresses the continental shelf, provides a procedure for delimitation of marine boundaries. ibid art 83 According to the provisions of Article 56(2), this procedure would arguably be applicable to delimitation of the EEZ as well.

[199] Ted L McDorman, 'The Continental Shelf' in in Donald R Rothwell and others (eds), *The Oxford Handbook of the Law of the Sea* (Oxford University Press 2015) (McDorman 2015) 199

[200] *Delimitation of the Maritime Boundary in the Bay of Bengal (Bangladesh/Myanmar)* (Judgment) (2012) ITLOS Rep 4 *(Bay of Bengal Case)* para 474

[201] LOSC (n 191) art 60

[202] ibid art 76(1)

resources of the seabed and subsoil' in its continental shelf[203], subject to requirements to allow other states rights of navigation, overflight and placement of submarine cables[204] and to preserve and protect the marine environment[205]. The International Court of Justice (ICJ), ITLOS and commentators all agree that, unlike rights in the EEZ water column that must be claimed in order to be effective, sovereign rights to continental shelves attach naturally to all coastal states under customary law.[206] In the *Bay of Bengal Case*, ITLOS reaffirmed that a state's right to its continental shelf 'exists by the sole fact' of its 'sovereignty over the land territory' and 'does not require the establishment of outer limits'.[207] With this right comes the power to demand that any development activity, including development of offshore freshwater resources, comply with all domestic laws and regulations, including requirements for permits, leases, licenses and concessions.[208]

An additional provision of LOSC that could apply to development of offshore freshwater resources is Article 85, which states that Part VI 'does not prejudice the right of the coastal state to exploit the subsoil by means of tunneling irrespective of the depth of the water above the subsoil'. Depending on the distance that offshore aquifers lie from the coast, tunneling may be the best means of accessing the water, although tunneling from shore to sea will be subject to environmental protection restrictions under LOSC, regional and domestic rules and may also be subject to integrated coastal zone management regulations which are described below.

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[203] ibid art 77 (1), 77(4)
[204] ibid art 58
[205] ibid art 56
[206] *North Sea Continental Shelf Cases (Federal Republic of Germany/Denmark; Federal Republic of Germany/Netherlands)* (Merits) (1969) ICJ Rep 3, 23 (*North Sea Continental Shelf Cases*); *Territorial and Maritime Dispute (Nicaragua v. Columbia)* (Judgment) (2012) ICJ Rep 624, 666; *Bay of Bengal Case (n 200)*; Ted L McDorman, 'The Entry into Force of the 1982 LOS Convention and the Article 76 Outer Continental Shelf Regime' (1995) 10 International Journal of Marine & Coastal Law 165, 167; RR Churchill and AV Lowe, *The Law of the Sea* (3rd edn, Manchester University Press 2002) 166; Tanaka 2012 (n 197) 133-4; McDorman 2015 (n 199) 191
[207] *Bay of Bengal Case* (n 200) para 407
[208] McDorman 2015 (n 199) 187

The breadth of a continental shelf area depends on the natural geological contours of the coastal floors[209], but LOSC grants a benefit to coastal states with narrow continental shelves by recognizing an EEZ Seabed that is co-extensive with the EEZ, i.e. a full two-hundred nautical miles.[210] Should a state be able to establish through a complicated set of criteria in Article 76 that its continental shelf extends beyond two hundred nautical miles from shore, that state may claim a broader continental shelf area, up to a maximum of three hundred fifty nautical miles from the low-water baseline.[211] This outer continental shelf (OCS) is subject to benefit-sharing provisions[212] that are examined below.

A state's rights in the continental shelf area 'are exclusive in the sense that if the coastal State does not explore the continental shelf or exploit its natural resources, no one may undertake these activities without the express consent of the coastal State'.[213] Further, while other states may lay submarine cables and pipelines along the continental shelf of a coastal state[214], '[t]he coastal State shall have the exclusive right to authorize and regulate drilling on the continental shelf for all purposes.'[215] Drilling is necessary to access offshore aquifers, and LOSC acknowledges the coastal state's right to regulate drilling activities that may accompany development of seabed aquifers, including placement of drilling rigs and usage and disposal of drilling fluids and cuttings.

A coastal state therefore possesses exclusive sovereign rights over freshwater resources lying in the seabed and subsoil of its territorial sea, its EEZ Seabed and its OCS. Those rights enable the state to choose the timing, extent and method of developing and distributing offshore freshwater, subject to limitations on sovereignty under customary international law, LOSC and any

[209] McDorman 2015 (n 199) 192
[210] LOSC (n 191) art 76(1)
[211] ibid art 76(5)
[212] ibid art 82
[213] ibid art 77(2)
[214] ibid art 79
[215] ibid art 81

regional agreements to which the state is a party, all of which are addressed below.

2.1.2 Benefit-sharing in the outer continental shelf

By allowing for states to claim rights to the OCS, LOSC expands the resource-rich territory that falls under national jurisdiction. Estimates of the additional area that cumulatively expands state jurisdiction over continental shelves vary, with the ISA giving a figure of fifteen million square kilometers[216] and Clive Schofield claiming that the area beyond national jurisdiction will shrink by an additional twenty-nine million square kilometers.[217] Roderick Ogley and Ian Brownlie expressed the obvious conclusion that the regimes for both the EEZ and the OCS have control of economically valuable natural resources as their guiding purpose.[218] In his 2012 article, Ted McDorman observed that only thirty-four states are in a position to claim an OCS and its natural resources[219], making the club of beneficiaries quite small.

Pursuant to LOSC, all claims of rights to the OCS must be filed with the Commission on the Limits of the Continental Shelf (CLCS), whose pronouncements are deemed by LOSC to be 'final and binding'[220]. Use of the term "final and binding seems to be inconsistent with customary law, which grants states rights to their continental shelves. However, since the LOSC mandates submission of a claim in order to protect OCS rights, then LOSC state-

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[216] ISA, 'Issues associated with the implementation of Article 82 of the United Nations Convention on the Law of the Sea' (Technical Study No. 4, 2009) (ISA Technical Study No. 4) x
[217] Schofield (n 189) 275
[218] Roderick C Ogley, 'The Law of the Sea Draft Convention and the New International Economic Order' (1981) 5 Marine Policy 240, 242; Ian Brownlie, *Principles of Public International Law* (7th edn, Oxford University Press 2008) 214 Clive Schofield agrees that extension of maritime jurisdictions 'raises significant potential resource opportunities'. Schofield (n 200) 275
[219] Ted L McDorman, 'The Role of the Commission on the Limits of the Continental Shelf: A Technical Body in a Political World' (2002) 17 International Journal of Marine & Coastal Law 301, 323 (McDorman 2002) Those states represent a mix of developed, developing and island states: Angola, Argentina, Australia, Brazil, Canada, Denmark, Ecuador, Fiji, France, Guinea, Guyana, Iceland, India, Indonesia, Ireland, Japan, Madagascar, Mauritius, Mexico, Micronesia, Myanmar, Namibia, New Zealand, Norway, Portugal, the Russian Federation, Seychelles, South Africa, Spain, Surinam, United Kingdom, United States and Uruguay.
[220] LOSC (n 180) art 76(8)

parties are bound to comply. Ted McDorman has written that the term 'final and binding' refers only to the inability of the state to amend its declared OCS once the limits have been submitted to and approved by the CLCS and have not received objections from other states.[221] Article 4 of LOSC's Annex II directs state-parties to submit the 'particulars' of their OCS claims to the CLCS, 'along with supporting scientific and technical data'. In addition, approval of a delimited OCS would give tremendous credibility to a state's claim over its OCS. Although the commission is not a judicial body and its rulings are thus not legally binding on states, its recommendations have been followed.[222] Unfortunately, the CLCS has accumulated a significant backlog of submissions[223] that could easily require decades to be cleared[224] and has made recommendations on only twenty-nine of seventy-nine submissions since 2002[225]. Another forty-seven preliminary submissions await completion of the submission files before they can even be considered by the CLCS.[226] Submission of an OCS claim to the CLCS is both costly and time-consuming: Japan reportedly

[221] McDorman 2002 (n 219) 315

[222] Jia Yu and Wu Ji-Lu, 'The Outer Continental Shelf of Coastal States and the Common Heritage of Mankind' (2011) 42 Ocean Development & International Law 317, 325

[223] Meeting of the Parties, 'Report of the twenty-seventh meeting of the Meeting of States Parties' (2017) UN Doc SPLOS/316 (2017 LOSC Meeting of the Parties) para 54

[224] ISA, 'Non-Living Resources of the Continental Shelf Beyond 200 Nautical Miles: Speculations on the Implementation of Article 82 of the United Nations Convention on the Law of the Sea' (Technical Study No. 5, 2010) (ISA Technical Study No. 5) executive summary

[225] 'Submissions, through the Secretary-General of the United Nations, to the Commission on the Limits of the Continental Shelf, pursuant to article 76, paragraph 8, of the United Nations Convention on the Law of the Sea of 10 December 1982' (*Oceans and Law of the Sea United Nations*, updated 08 May 2018) <http://www.un.org/depts/los/clcs_new/commission_submissions.htm> accessed 30 June 2018

[226] 'Preliminary information indicative of the outer limits of the continental shelf beyond 200 nautical miles (paragraph 8, of the United Nations Convention on the Law of the Sea of 10 December 1982' (*Oceans and the Law of the Sea United Nations*, updated 08 December 2017) <http://www.un.org/depts/los/clcs_new/commission_preliminary.htm> accessed 30 July 2018 Pursuant to a decision issued in 2008, the CLCS is not obligated to review a preliminary submission. Meeting of States Parties, 'Decision regarding the workload of the Commission on the Limits of the Continental Shelf and the ability of States, particularly developing States, to fulfil the requirements of article 4 of annex II to the United Nations Convention on the Law of the Sea, as well as the decision contained in SPLOS/72, paragraph (a)' (2008) UN Doc SPLOS/183

spent more than US$ 500 million preparing its claim[227], and Australia needed more than a decade to complete its own submission[228].

Perhaps the most remarkable article in Part VI contains a benefit-sharing provision that stands as a hybrid between a state's exclusive right to explore, exploit[229] and drill for resources[230] within its outer continental shelf and the communal approach taken to natural resources in the area beyond national jurisdiction, where seabed minerals are viewed as the common heritage of mankind.[231] After five years of production of resources within the OCS, Article 82 mandates that a state 'make payments or contributions in kind'[232] to the International Seabed Authority (ISA) at a rate of one percent of 'the value or volume of production at the site'.[233] The value of the payments or the contributions in kind increases by one percent each year, until they reach a maximum of seven percent of 'the value or volume of production' after twelve years.[234] The ISA must then distribute the benefits to LOSC parties 'on the basis of equitable sharing criteria, taking into account the interests and needs of developing States, particularly the least-developed and the land-locked among them'.[235]

In a concession to developing states, a 'developing State which is a net importer of a mineral resource produced from its continental shelf is exempt from making such payments or contributions in respect of that mineral resource.'[236] The benefit-sharing mechanism in Article 82 was the quid pro quo for developing states to agree to the concept of an OCS, since an extension of the

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[227] Schofield (n 189) 281
[228] ibid 282
[229] ibid art 77
[230] ibid art 81
[231] LOSC (n 180) art 136-137 However, in the opinion of the ISA, the LOSC benefit-sharing provisions with respect to the OCS 'are not a reflection of the common heritage principle', and the Area is therefore the only part of the ocean where the philosophy of a common heritage of mankind applies. ISA Technical Study No. 4 (n 216) 23
[232] LOSC (n 180) art 82(1)
[233] ibid art 82(2)
[234] ibid art 82(2)
[235] ibid art 82(4)
[236] ibid art 82(3)

continental shelf reduces the size of the Area whose resources are meant to benefit developing states.[237] Further, in most if not all cases only the developed states would have the financial and technical ability to harvest natural resources so far from the coast.[238] The mandate for benefit-sharing through the ISA manifests an intention to achieve some degree of equitable distribution of the bounty of the sea.

Large-scale exploitation of the OCS has not yet begun[239], but technological advancements may outpace the ability of the CLCS to render timely recommendations. While freshwater aquifers are not expected to be found in the OCS, methane hydrates certainly exist there. In its 2010 study, the ISA highlighted the vast potential of methane hydrates in the OCS, which could hold 'ten times the fuel value of current conventional gas and oil resources', while being 'probably the widest distributed, yet so far least accessible mineral

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[237] Andree Kirchner, 'The Outer Continental Shelf: Background and Current Developments' in Tafsir Malick Ndiaye and Rüdiger Wolfrum (eds), *Law of the Sea, Environmental Law and Settlement of Disputes* (Martinus Nijhoff 2007) 602-3; ISA Technical Study No. 5 (n 224) 1; ISA, 'Implementation of Article 82 of the United Nations Convention on the Law of the Sea: report of the International Workshop convened by the International Seabed Authority' (Technical Study No. 12, 26-30 November 2012) (ISA Technical Study No. 12) 43. The concept of sharing benefits derived from the OCS was initially proposed by the US negotiators. ISA Technical Study No. 4 (n 216) 15

[238] Yoshifumi Tanaka, 'Protection of Community Interests in International Law: The Case of the Law of the Sea' (2011) in A von Bogdandy and R Wolfrum, (eds), *15 Max Planck Yearbook of United Nations Law* (Koninklijke Brill N.V. 2011) (Tanaka 2011) 341

[239] Japan was the first nation to utilize deep seabed mining successfully to extract ploymetallic ore within its EEZ. 'Japan successfully undertakes large-scale deep-sea mineral extraction' (*The Japan Times*, 26 September 2017) <https://www.japantimes.co.jp/news/2017/09/26/national/japan-successfully-undertakes-large-scale-deep-sea-mineral-extraction/#.W23HES3Myt8> accessed 10 August 2018 Another deep seabed mining project was scheduled to extract polymetallic sulfides within Papua New Guinea's EEZ commencing in 2019. 'World's First Deepsea Mining Support Vessel Launched' (*The Maritime Executive*, 29 March 2018) <https://www.maritime-executive.com/article/world-s-first-deepsea-mining-support-vessel-launched#gs.PMAh1Qo> accessed 20 July 2018 However, the project has been mired in controversy about its environmental impact and has lost such a significant portion of its funding that its future viability is very much in doubt. Helen Davidson and Ben Doherty, 'Troubled Papua New Guinea deep-sea mine faces environmental challenge' (*The Guardian*, 11 December 2017) <https://www.theguardian.com/world/2017/dec/12/troubled-papua-new-guinea-deep-sea-mine-faces-environmental-challenge> accessed 20 July 2018 'Nautilus' stock plummets as deep sea mining litigation proceeds' (*Deep Sea Mining Campaign*, 17 July 2018) <http://www.deepseaminingoutofourdepth.org/nautilus-stock-plummets-as-deep-sea-mining-litigation-proceeds/> accessed 20 July 2018

resource of the OCS'.[240] With so much financial gain to be accrued from methane hydrates, there can be little doubt that technology will soon enable their exploitation, and perhaps will also permit the freshwater to be captured instead of discarded in favor of the methane. Any proceeds derived from their development in the OCS will be subject to the LOSC benefit-sharing provisions.

Since LOSC Article 82 entitles the ISA to receive and distribute 'payments or contributions in kind' equal to up to seven percent of the value or production derived from OCS natural resources, the ISA has produced three technical studies on the OCS.[241] In the first study, produced in 2009, the ISA observed that LOSC assigns responsibilities to the ISA but with little guidance, leaving the ISA to determine for itself its roles and tasks.[242] To begin its analysis, the ISA listed a number of issues that concern the state claiming an OCS: commercial viability of production; lack of procedure for payments; the meaning of 'value' when calculating the payment to the ISA; the point at which production is deemed to have begun, and implementation of domestic laws to conform with Article 82.[243] In addition, the 2009 technical study listed issues that must be considered by the ISA: informing relevant states about the implications of Article 82; raising institutional capacity within the ISA; ensuring adequate exchanges of information with the relevant state; costs of administration; the purpose and application of payments to beneficiary states, and the meaning of 'equitable criteria'.[244] In an effort to begin the process of structuring administration of the OCS, the ISA published the framework of an agreement between the ISA and the OCS state that was drafted by Aldo Chircop.[245]

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[240] ISA Technical Study No. 5 (n 224) 28
[241] ISA Technical Study No. 4 (n 216); ISA Technical Study No. 5 (n 224); ISA Technical Study No. 12 (n 237)
[242] ISA Technical Study No. 4 (n 216) 53
[243] ibid xv
[244] ibid xvi, xvii
[245] Aldo Chircop, 'Working Paper on Development of Guidelines for Implementation of Article 82 by Professor Aldo Chircop, Marine and Environmental Law Institute, Schulich School of Law, Dalhousie University, Canada' in ISA Technical Study No, 12 (n 237) annex 4

Any state wishing to develop methane hydrates and any recoverable freshwater in the OCS in the near future will be forced to navigate all of the financial concerns identified by the ISA regarding commercial viability and the calculation of payments to be made to the ISA. In addition, domestic laws for freshwater resource development in the OCS will have to be harmonized, drafted and/or adopted. An agreement with the ISA must be negotiated and executed by the relevant state, but the ISA has not yet produced a final draft of a proposed agreement. Given all of the unanswered questions that still swirl around the benefit-sharing provisions of Part VI, the delay in developing resources in the OCS seems to be beneficial to all parties. However, the advent of deep seabed mining can probably be measured in years instead of decades, so one can hope that the ISA will be in a position to produce the required guidance soon.

2.1.3 CHM in the ABNJ

Successful advocacy for the principle of the common heritage of mankind (CHM) led to the first post-WWII attempt to limit sovereignty and to distribute more equitably the resources located beyond the EEZs and OCSs, a space that LOSC eponymously dubbed the 'Area'.[246] In the Area, which is in an area beyond beyond national jurisdiction (ABNJ), natural resources have been labeled as CHM[247] and benefits are to be shared on an equitable basis.[248] Although LOSC specifically mentions polymetallic nodules[249], resources for purposes of CHM are defined quite broadly as all solid, liquid or gaseous mineral resources *in situ* in the Area at or beneath the seabed'.[250] No resources have yet been redistributed or even extracted pursuant to the CHM provisions, but CHM is considered in this thesis since freshwater resources in the form of the water

[246] LOSC (n 180) art 1(1)(1)
[247] ibid art 136
[248] ibid art 140(2)
[249] ibid art 133(a)
[250] ibid art 133 Article 133(b) clarifies that within the LOSC recovered resources are referred to as 'minerals'.

component of methane hydrates may fall within the Area if they lie beyond the OCS or if a state does not lay claim to its full OCS rights.

Part XI of LOSC contains the fifty-nine articles regulating activities in the Area beyond national jurisdiction. Article 137 states that 'no claim of sovereignty or sovereign rights . . .will be recognized' and the 'resources are not subject to alienation'; once recovered, the minerals from the Area may be distributed only pursuant to LOSC.[251] While the LOSC remains the most expansive expression of CHM to appear in a global treaty, the viability and legacy of the CHM principle were threatened even before the LOSC came into effect. The provisions regarding sharing the natural resources of the seabed in the Area proved to be unacceptable to developed states[252], particularly the US, the Federal Republic of Germany and the United Kingdom[253], and the absence of developed states in the membership of LOSC would have eviscerated the effectiveness of the convention.[254] In an effort to achieve universal acceptance of LOSC,[255] the 1994 Implementation Agreement was adopted[256] to amend Part XI and make it more acceptable to developed countries.

Some commentators believe that the 1994 Implementation Agreement undermined the essence of the CHM regime since developing states no longer benefit from mandatory transfer of technology and any state-party can veto monetary distributions.[257] In fact, in a 2012 article MCW Pinto characterized the 1994 Implementation Agreement as having 'destroyed the myth' of CHM,[258]

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[251] ibid art 137(1), 137(2)
[252] Michael W Lodge, 'The Common Heritage of Mankind' (2012) 27 International Journal of Marine & Coastal Law 733, 736 (Lodge 2012)
[253] Scott J Shackelford, 'Was Selden Right: The Expansion of Closed Seas and Its Consequences' (2011) 47 Stanford Journal of International Law 1, 23
[254] Tanaka 2011 (n 238) 346
[255] John E Noyes, 'The Common Heritage of Mankind: Past, Present, and Future' (2012) 40 Denver Journal of International Law & Policy 447, 463 (Noyes 2012); Lodge 2012 (n 252) 738
[256] Agreement Relating to the Implementation of Part XI of the United Nations Convention on the Law of the Sea of 10 December 1982 (adopted 28 July 1994, entered into force 28 July 1996) 1836 UNTS 3
[257] Noyes 2012 (n 255) 464
[258] MCW Pinto, 'The Common Heritage of Mankind: Then and Now' (2012) 361 Recueil des Cours de l'Académie de Droit International de La Haye 111

a myth he called 'an emotive metaphor' that 'came to imply distributive justice, cooperation and preferential treatment for the poor'.[259] In an article published the year before Pinto's, Yoshifumi Tanaka argued that the 1994 Implementation Agreement had not in fact destroyed 'the essence of the principle of the common heritage of mankind'[260] since 'the principal elements . . . remain intact'[261]. Although in 1992 Rüdiger Wolfrum viewed CHM as 'part of customary law'[262], six years later Kemal Baslar wrote that '[m]aking the common heritage a binding principle of international law to protect the vital interests of mankind by way of the rational hypothetical theory does not seem to be plausible for the time being'[263] and dubbed the final structure of CHM in LOSC to be 'a triumph of *laissez faire*'[264].

Michael Lodge, Secretary General of the ISA, has been more hopeful by recognizing aspects of the CHM principle in multiple international agreements in various sectors such as 'human rights, cultural heritage, labour, public health, telecommunications, outer space, Antarctica and the environment'.[265] From a practical standpoint, Lodge observed that as of 2012 'developing countries have precious little to show for more than fifteen years of effort. No commercial mining has yet taken place and no financial benefits have yet accrued from the Area.'[266] Dire Tladi wrote in 2015 that for practical reasons CHM is being

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[259] ibid 110
[260] Tanaka 2011 (n 238) 347
[261] ibid 349
[262] Rüdiger Wolfrum, 'Common Heritage of Mankind' in Rudolf Bernhardt (ed), *Encyclopedia of Public International Law, Vol I* (1992) 694. A decade earlier, Wolfrum took the opposite view, stating that CHM was not part of customary law. Rüdiger Wolfrum, 'The Principle of the Common Heritage of Mankind' (1983) 43 Zeitschrift For Auslandisches Offentliches Recht Und Volkerrecht 312, 337
[263] Kemal Baslar, *The Concept of the Common Heritage of Mankind in International Law* (Martinus Nijhoff Publishers 1998) 150
[264] ibid 126
[265] Lodge 2012 (n 252) 734
[266] ibid 738 A March 2018 ISA newsletter confirms that commercial mining has yet to commence, although the ISA has executed twenty-nine contracts for exploration. 'ISA Newsletter' (*International Seabed Authority* March 2018) 1 <https://www.isa.org.jm/files/documents/EN/Newsletter/2018/Mar.pdf> accessed 7 July 2018

replaced in the lexicon by the term 'benefit-sharing' in order to avoid the controversies surrounding the words 'common heritage of mankind'.[267]

In another context, the principle of 'province of all mankind' that appears in the Outer Space Treaty has been interpreted to mean equal access to space, not to its benefits[268], which is a dubious right given the small number of parties that have the financial ability to engage in space exploration. The Moon Treaty, which specifically provides for CHM, has not received wide support due to controversy over application of that principle.[269] It seems fair to say that support for principles such as CHM comes mostly from the developing countries that need it most and are least capable of implementing it. Regardless of how CHM is characterized, the fact remains that the principle survives in LOSC, awaiting its first opportunity to be deployed as a mechanism for equitable distribution of non-living marine resources.

The final boundary lines of the Area will not be determined until national claims to the OCS are fully resolved, and rights to minerals in the Area are therefore linked to rights in the OCS. While the LOSC provisions for administering the resources in the OCS and in the Area differ, at least two commentators believe that the Mining Code that is being produced by the ISA can be instructive and perhaps influential for OCS activities.[270] Developing nations especially may find that utilizing the work of the ISA such as the Mining Code will save those nations time, effort and money when they create governance regimes for their domestic OCS resources.

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[267] Dire Tladi, 'The Common Heritage of Mankind and the Proposed Treaty on Biodiversity in Areas beyond National Jurisdiction: The Choice between Pragmatism and Sustainability' (2015) 25 Yearbook of international Environmental Law 113, 114 Benefit-sharing will be addressed more fully in Chapter 5.2.2.

[268] Joanne Irene Gabrynowicz and Jacqueline Etil Serrao, 'An Introduction to Space Law for Decision Makers' (2004) 30 Journal of Space Law 227, 229; Daniel A Porras, 'The Common Heritage of Outer Space: Equal Benefits for Most of Mankind' (2006) 37 California Western International Law Journal 143, 175-6

[269] Leslie I Tennen, 'Towards a New Regime for Exploitation of Outer Space Mineral Resources' (2010) 88 Nebraska Law Review 794, 822

[270] Clive Schofield and Robert van de Poll, 'Exploring The Outer Continental Shelf Working Paper' in ISA Technical Study No 12 (n 237) 80

The ISA Mining Code, which is automatically binding on all parties[271], actually consists of several sets of regulations addressing the three types of mineral resources that were foreseen as being valuable at the time that UNCLOS was being negotiated: polymetallic nodules, polymetallic sulfides and cobalt-rich ferromanganese crusts. The ISA first produced regulations regarding prospecting and exploration for polymetallic nodules in 2000[272], followed by similar regulations for polymetallic sulfides in 2010[273] and most recently for cobalt-rich ferromanganese crusts in 2012[274]. Michael Lodge noted that '[t]he three sets of regulations are broadly similar in format, scope and content, with differences primarily to reflect the different spatial and geological characteristics of the mineral resources they deal with.'[275]. In addition, the ISA has issued an environmental management plan for the Clarion- Clipperton Zone[276], adopted guidance for contractors regarding assessments of

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[271] James Harrison, 'The Sustainable Development of Mineral Resources in the International Seabed Area: the Role of the Authority in Balancing Economic Development and Environmental Protection' (2014) Scottish Centre for International Law Working Paper Series, Working Paper No 3, 14

[272] ISA Assembly, 'Decision of the Assembly relating to the regulations on prospecting and exploration for polymetallic nodules in the Area' (13 July 2000) UN Doc ISBA/6/A/18, amended by ISA Council, 'Decision of the Council of the International Seabed Authority relating to amendments to the Regulations on Prospecting and Exploration for Polymetallic Nodules in the Area and related matters' (22 July 2013) UN Doc ISBA/19/C/17 and ISA Assembly, 'Decision of the Assembly of the International Seabed Authority relating to amendments to regulation 21 of the Regulations on Prospecting and Exploration for Polymetallic Nodules in the Area' (24 July 2014) UN Doc ISBA/20/A/9 (Nodules Exploration Regulations)

[273] ISA Assembly, 'Decision of the Assembly of the International Seabed Authority relating to the regulations on prospecting and exploration for polymetallic sulphides in the Area' (15 November 2010) UN Doc ISBA/16/A/12/Rev 1, amended by ISA Assembly, 'Decision of the Assembly of the International Seabed Authority concerning overhead charges for the administration and supervision of exploration contracts' (25 July 2013) UN Doc ISBA/19/A/12 (Sulfides Exploration Regulations)

[274] ISA Assembly, 'Decision of the Assembly of the International Seabed Authority relating to the Regulations on Prospecting and Exploration for Cobalt-rich Ferromanganese Crusts in the Area' (27 July 2012) UN Doc ISBA/18/A/11 (27 July 2012), amended by ISA Assembly, 'Decision of the Assembly of the International Seabed Authority concerning overhead charges for the administration and supervision of exploration contracts' (25 July 2013) UN Doc ISBA/19/A/12 (Crusts Exploration Regulations)

[275] Michael Lodge and others, 'Seabed mining: International Seabed Authority environmental management plan for the Clarion–Clipperton Zone. A partnership approach' (2014) 49 Marine Policy 66, 67

[276] ISA Legal and Technical Commission, 'Environmental Management Plan for the Clarion-Clipperton Zone' (2011) UN Doc ISBA/17/LTC/7 (ISA EMP for Clarion-Clipperton Zone); ISA Council, 'Decision of the Council relating to an environmental management plan for the Clarion-

environmental impacts arising from deep seabed mining (DSM)[277] and has issued draft regulations for exploitation of mineral resources located in the deep seabed that includes implementation of the precautionary approach[278].

Further additions to the Mining Code can probably be expected as the technical ability to conduct DSM comes closer to reality, and the Mining Code can be expected to include other types of valuable minerals that may be discovered. Should methane hydrates be discovered and developed in the Area, they will be considered as CHM, with the exact mechanism of distribution yet to be determined or tested. Should technology allow for freshwater to be separated from the methane and stored, it is possible that the two natural resources will be treated differently for CHM purposes, since freshwater is vital to life and methane is prized for its commercial value. At the moment CHM is more focused on distribution of commercial benefits, which leaves a gap in its application where vital resources are concerned. Regardless of how CHM is interpreted and applied, the provisions of the Mining Code relating to environmental impact assessments will almost certainly be applicable, as will the implementing agreement currently being negotiated to protect biodiversity in the Area[279].

2.1.4 Transboundary resources

The preceding sections described rights that sovereigns possess to natural resources that lie in seabeds within what is considered to be their exclusive

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Clipperton Zone' (2012) UN Doc ISBA/18/C/22 (ISA Council EMP Decision) The Clarion-Clipperton Zone is an area of the deep seabed that is found in the eastern central Pacific and has attracted interest due to the presence of polymetallic nodules that may cause it to be the first part of the Area to be developed. ibid paras 14, 16

[277] ISA Legal and Technical Commission, 'Recommendations for the guidance of contractors for the assessment of the possible environmental impacts arising from exploration for marine minerals in the Area' (1 March 2013) UN Doc ISBA/19/LTC/8 The ISA has also produced a technical study on the topic of environmental impact assessments. ISA, 'Environmental Management Needs for Exploration and Exploitation of Deep Sea Minerals' (Technical Study No. 10, 2011) (Technical Study No. 10)

[278] ISA Legal and Technical Commission, 'Draft Regulations on Exploitation of Mineral Resources in the Area' (30 April 2018) UN Doc ISBA/24/LTC/WP.1 (ISA Draft Exploitation Regulations) Draft Regulation 46(a)

[279] The prospective implementing agreement is discussed in Chapter 2.2.5.

domains in the territorial seas, EEZ Seabeds and OCS. However, the sheer number of coastal states who are either adjacent or opposite to one another has produced a variety of multitude of transboundary natural resources shared by two or more states. Due to the vast areas being assigned to state jurisdiction, overlapping claims to territorial seas, EEZ Seabeds and the OCS raise the potential for disputes over delimited boundaries and shared resources.[280]

According to a working paper authored by Clive Schofield and Robert van de Poll that accompanied a 2012 ISA technical study, more than three million square miles are subject to overlapping claims in OCS areas.[281] In the Asia-Pacific region alone, fifteen nations have made varying overlapping claims[282] to more than twenty-six percent of the region's potential OCS[283]. As stated earlier, the CLCS has a backlog of OCS claims that could take decades to complete, and, as Schofield and van de Poll note, this uncertainty regarding maritime claims could have the effect of delaying development of seabed resources – and the accompanying distributed benefits – since financing parties may be reluctant to invest the substantial sums required in the face of political uncertainty.[284] Nevertheless, according to the ISA, uncertainty about the exact delimitation of the OCS will not prohibit a state from developing its OCS natural resources[285], and a joint development arrangement between the state and the ISA may be a solution to any impasse on delimited boundaries.

While LOSC is fairly clear regarding governance of seabed natural resources that fall within the jurisdiction of one nation, the question of governance of transboundary natural resources receives almost no guidance in the treaty. Martti Koskenniemi noted that lack of clarity in LOSC is typical of the tendency in modern international law instruments to retreat from substantive issues and

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[280] Schofield (n 189) 276
[281] Schofield and van de Poll (n 270) 72
[282] ibid 73
[283] ibid 79
[284] ibid
[285] ISA Technical Study No 5 (n 224) 14 The ISA advised that '[o]ne potential approach to consider in cases of maritime boundary disputes are joint development zones for offshore mining. ' ISA Technical Study No. 10 (277) 29

thereby allow nations to seek their own solutions through the treaty framework, provided that the resolution aligns with 'equitable principles'.[286] The only indirect guidance can be found in the provisions regarding delimiting boundaries between states. LOSC treats delimitation of the boundary of the territorial sea differently from delimitation of the EEZ and the OCS. With respect to the territorial sea, states are to use the equidistant method of drawing the boundary line, except 'where it is necessary by reason of historic title or other special circumstances to delimit the territorial seas of the two States in a way which is at variance therewith.'[287] By contrast, states concerned with delimitation of boundaries in the EEZ and the OCS – whether the coasts are adjacent or opposite -- are simply directed to find an equitable solution that is consistent with international law.[288] While the states seek their equitable solution, they 'shall make every effort to enter into provisional arrangements of a practical nature and, during this transitional period, not to jeopardize or hamper the reaching of the final agreement.'[289] Unresolved disputes are to be adjudicated in accordance with the dispute settlement procedures found in Part XV of LOSC.[290]

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[286] Martti Koskenniemi, 'The Politics of International Law' (1990) 1 European Journal of International Law 4, 28 (Koskenniemi 1990)

[287] LOSC (n 180) art 15 The issue of delimitation of marine boundaries remains topical and contentious, and as recently as 2014 two disputes over delimitation were brought to the ICJ for resolution. Adjacent states Somalia and Kenya, both of whom are parties to LOSC, requested that the ICJ resolve their dispute over delimitation of the territorial sea, the EEZ and the continental shelf. *Dispute Concerning Maritime Delimitation in the Indian Ocean (Somalia v. Kenya)* (Application) (filed 28 August 2014) ICJ In 2014 Costa Rica also filed an application with the ICJ to resolve its dispute over maritime delimitation with its adjacent neighbor Nicaragua. The ICJ accepted jurisdiction even though neither state is a party to LOSC; the dispute is complicated by the fact that the parties share waters in both the Caribbean Sea and the Pacific Ocean. *Maritime Delimitation in the Caribbean Sea and the Pacific Ocean (Costa Rica v. Nicaragua)* (Application) (filed 25 February 2014) ICJ Nicaragua has also been party to a series of ICJ cases involving a dispute over maritime delimitations of its EEZ and continental shelf that overlap with Colombia's EEZ and continental shelf. In these cases, the Pact of Bogotá provides for ICJ jurisdiction over disputes, and the Court ruled that the parties should divide their overlapping entitlements equally. *Territorial and Maritime Dispute (Nicaragua V. Colombia)* (Judgment) (2012) ICJ Rep 624

[288] LOSC (n 180) art 74(1), 83(1)

[289] ibid art 74(3), 83(3)

[290] ibid art 74(2), 83(2)

States eager to develop seabed natural resources have found other forms of guidance to resolve uncertainties over conflicting claims. For fifteen years prior to the time that LOSC was opened for signature and ratification in 1982, the ICJ had been issuing judgments that involved delimitation of maritime boundaries in the context of shared natural resources, and each time the ICJ's advice presaged – and probably influenced -- the LOSC direction for states to find equitable solutions. As stated earlier and as will be described in greater detail in Chapter 4, a number of the ICJ cases on maritime delimitation involved exploitation of petroleum resources.[291]

Predictions of ubiquitous offshore freshwater resources logically engender further predictions of reserves that are transected by one or more international boundaries. Even today, not all maritime boundaries have been delimited. Several of the bilateral hydrocarbon development treaties that are described in Chapter 4 illustrate that development of offshore transboundary natural resources is not dependent on final maritime delimitation, and states have found bilateral solutions on a case-by-case basis. As suggested earlier, the ability of states to find practical solutions to development of transboundary natural resources may prove to be helpful for transboundary resources located in the OCS where OCS boundaries have not been clarified. However, for those maritime boundaries that have been delimited, in the author's opinion at least ten possible types of transboundary reserves exist. Those ten types are listed below with a brief description of each.

1. A reserve straddles the boundary between two or more territorial seas, thus affecting the sovereignty of two or more states in their territorial seas

2. A reserve straddles the boundary between one or more territorial seas and the EEZ Seabed of one or more states, thus affecting the sovereignty of

[291] *North Sea Continental Shelf Cases (Federal Republic of Germany/Denmark; Federal Republic of Germany/Netherlands)* (Merits) (1969) ICJ Rep 3 (*North Sea Continental Shelf Cases*); *Case Concerning the Continental Shelf (Tunisia/Libyan Arab Jamahiriya)* (Merits) (1982) ICJ Rep 18; *Case Concerning Continental Shelf (Libyan Arab Jamahiriya/Malta)* (Merits) (1985) ICJ Rep 13

states in their territorial sea and sovereign rights of two or more states in their EEZ Seabeds

3. A reserve straddles the boundary between two or more EEZ Seabeds, thus affecting the sovereign rights of those states in their EEZ Seabeds

4. A reserve straddles the boundary between one or more territorial seas and the OCS of one or more states, thus affecting the sovereignty of one or more states in their territorial sea, the sovereign rights of one or more additional states in their OCS, and the interests of the ISA in the OCS

5. A reserve straddles the boundary between the EEZ Seabed of one or more states and the OCS of one or more additional states, thus affecting the sovereign rights of one or more states in the EEZ Seabed and in the OCS and the interests of the ISA in the OCS

6. A reserve straddles the boundary between one state's EEZ Seabed and its OCS, thus affecting the sovereign rights of that state in its EEZ Seabed and its OCS and the interests of the ISA in the OCS

7. A reserve straddles the boundary between the OCS of two or more states, thus affecting the sovereign rights of those states their OCS and the interests of the ISA in the OCS

8. A reserve straddles the boundary separating one or more EEZ Seabeds and the Area thus affecting the sovereign rights of a state in its EEZ Seabed and the interests of the ISA in the Area

9. A reserve straddles the boundary separating the EEZ Seabed of one or more states, the OCS of one or more additional states and the Area, thus affecting the sovereign rights of the relevant states in their EEZ Seabed and their OCS and the interest of the ISA in the OCS and in the Area

10. A reserve straddles the boundary separating the OCS of one or more states and the Area, thus affecting the sovereign interests in the OCS and the interests of the ISA in the OCS and in the Area

Regarding transboundary freshwater resources located in the territorial seas, the EEZ Seabeds and/or the OCS, states will doubtless refer to hydrocarbon practices such as unitization and joint development agreements for guidance.

To fill the governance void for OCS resources, the ISA's 2009 Technical Study No. 4 provided guidance on transboundary resources[292] and included gas (methane) hydrates as an example of an OCS natural resource that would fall within the purview of LOSC's Article 82[293]. Technical Study No. 4 clarified that Article 82 governs development of a natural resource that lies within the OCS, regardless of the location of the development site, whereas a resource lying within the EEZ Seabed falls outside the scope of Article 82, even if the development site is in the OCS.[294] Where a state is developing a resource that straddles its EEZ Seabed and its OCS, the state will have to determine what proportion of the resource lies within the OCS.[295] When the OCS resource of one state straddles the EEZ Seabed of another state and when the OCS resource of one state straddles the OCS of another OCS state, Technical Study No. 4 presumes that unitization will be utilized 'as a matter of good practice'.[296] Finally, the ISA has an interest in transboundary resources that straddle a state's EEZ Seabed or OCS and the Area. In those cases, the ISA acknowledges that 'the body of treaty and judicial practice' may not be directly applicable since the ISA is an intergovernmental body. However, the ISA advocates that the system of bilateral joint development agreements apply, both because 'unitization is a good practice' and because 'the general purpose of cooperative transboundary resource arrangements is to ensure efficiency and equity between neighbours'.[297] Under this type of arrangement, the proportion of the resource to be attributed to the state and to the ISA would be a matter of negotiation. Since no resource development has begun in the Area, the structure of an arrangement for transboundary resources that straddle the Area and areas within national jurisdiction such as the EEZ Seabed and the OCS has yet to be defined. The first structure that is agreed will doubtless serve as a template for future arrangements for transboundary resources, including any offshore freshwater that may be present that far from shore.

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[292] ISA Technical Study No. 4 (n 216) 59
[293] ibid x
[294] ibid 59
[295] ibid 60
[296] ibid 61
[297] ibid 63

2.2 Protection of the marine environment

While sovereign rights to access and ownership of marine-based natural resources have been the primary focus of state activities and diplomatic discussions for centuries, a growing global chorus has been actively promoting protection of the marine environment. Development of seabed resources such as offshore aquifers and methane hydrates can have significant and sometimes permanent impacts on the surrounding marine environment. The intrusion on marine ecosystems begins with seismic surveys and vessel traffic during the exploration phase and continues with lights, anchors, drilling rigs, drilling fluids and cuttings, pipelines, dredging, contaminants and noise during the extraction phase.[298] Part XII of LOSC describes state 'obligation to protect and preserve the marine environment'[299], but concern for ocean habitats had its roots in earlier judicial decisions and multilateral pronouncements. Unfortunately, the legal regimes for marine environmental protection consist of highly fragmented and occasionally overlapping laws and rules, with LOSC, regional treaties, national laws, sectoral obligations, bilateral agreements and judicial opinions all playing roles in directing state actions.[300] From a practical viewpoint, this patchwork of laws will impact development of offshore freshwater through laws and regulations focused on protection of marine organisms and biodiversity in the seabed of the development site and in the surrounding areas, including the water column. The potential of transboundary harm has also engendered prophylactic legal measures that will have to be observed. This subsection will explain some of the foundational cases and multilateral declarations before describing the currently applicable treaties.

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[298] Erik E Cordes and others, 'Environmental Impacts of the Deep-Water Oil and Gas Industry: A Review to Guide Management Strategies' (2016) 4:58 Frontiers of Environmental Science 1, 5 A more detailed description of the effects of seabed resource development is provided in Chapter 4.4.

[299] LOSC (n 180) art 192

[300] James Harrison, *Saving the Oceans Through Law* (Oxford University Press 2017) 275

2.2.1 Judicial action supporting environmental protection

Trail Smelter[301] was one of the earliest judicial decisions limiting a state's sovereignty when harmful transboundary effects will result from activities taking place in that state. *Trail Smelter* served as the harbinger of the principle that no nation can cause significant harm to its neighbor without being held accountable for damages. However, the *Trail Smelter* tribunal's final opinion actually gave judicial permission for nations to cause transboundary environmental harm, with the only penalty being an obligation to reimburse the injured state for monetized damages. Logically, although the concept has been dubbed the 'no significant harm' principle, in reality there is no injunction in international law prohibiting domestic or transboundary environmental damage. Minimal and even moderate harm would be allowed under the 'no significant harm' principle, and compensation for significant harm would first have to be demanded and possibly litigated before the polluting state would be held accountable. Of course, securing payment of awarded damages may require even more time and effort and may ultimately be futile. Injunctions would be even more difficult to obtain. Nevertheless, the international community has agreed that a sovereign should be held accountable when its actions result in significant harm beyond its own borders, making the no significant harm principle a clear limitation on sovereign actions.[302]

Subsequent cases put further refinements on limitations to total sovereignty. In its 1996 advisory opinion on *Legality of the Threat or Use of Nuclear Weapons*[303] (*Nuclear Weapons*), the ICJ indicated that avoiding transboundary environmental harm remained a consideration even in times of war:

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[301] *Trail Smelter (U.S. v. Canada)*, 3 RIAA 1911 (1938, 1941)
[302] The conflicts that arose in international water law over balancing the no significant harm principle and the principle of equitable and reasonable utilization of water will be described in Chapter 3.
[303] *Legality of the Threat or Use of Nuclear Weapons* (Advisory Opinion) (1996) ICJ Reports 226 (*Nuclear Weapons*)

> The Court thus finds that while the existing international law relating to the protection and safeguarding of the environment does not specifically prohibit the use of nuclear weapons, it indicates important environmental factors that are properly to be taken into account in the context of the implementation of the principles and rules of the law applicable in armed conflict. [304]

This language can be considered dicta, since the principle of no significant harm was not one of the questions posed to the Court when the UN General Assembly sought legal advice on the use of nuclear weapons, nor was the principle included in any of the rulings on which the court voted in rendering the opinion. Nevertheless, this dicta has been acknowledged as a limitation on state sovereignty where a state's actions would have an adverse impact on the environment of another state. Philippe Sands goes so far as to state that after the *Nuclear Weapons* advisory opinion,

> there can be no question but that Principle 21 [regarding protection of the environment] reflects a rule of customary international law, placing international legal constraints on the rights of states in respect of activities carried out within their territory or within their jurisdiction.[305]

Günther Handl reflected that in *Nuclear Weapons* and *Pulp Mills* 'the International Court of Justice expressly endorsed the obligation [to avoid environmental harm] as a rule of international customary law'[306].

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[304] ibid, 243, para 33.
[305] Philippe Sands, *Principles of International Environmental Law* (2nd edn, Cambridge University Press 2003) 241 *See also* Ayesha Diaz, 'Permanent Sovereignty over Natural Resources' (1994) 24 Environmental Policy and Law 156, 159
[306] Günther Handl, 'Declaration of the United Nations Conference on the Human Environment and Rio Declaration on Environment and Development' (*UN Audiovisual Library of International Law.* <http://legal.un.org/avl/ha/dunche/dunche.html> accessed 24 January 2018 *Pulp Mills* and other important judicial decisions that address limitations on sovereignty in the context of freshwater, such as *River Oder, River Meuse, Lake Lanoux* and *Gabčíkovo-Nagymaros Project,* will be discussed in Chapter 3.

Not all restrictions on sovereignty relate to transboundary harm. The *Corfu Channel Case*[307] was an early decision by the newly formed ICJ that imposed restrictions on actions taken by a nation in its own territorial sea. In October 1946, after the end of the Second World War, four British war ships passed through the North Corfu Strait, a narrow channel separating the island of Corfu from Albania. Britain had recently swept the area for mines, and so its ships passed confidently through the channel in a show of military strength. One of the ships was severely damaged when it hit a moored mine, and another ship hit a second moored mine while towing the first one to shore.[308] Through inductive reasoning based on circumstantial evidence, the court determined that Albania was aware of the placement of the mines[309], and then concluded that Albania was liable under international law to compensate Britain for damage to the ships[310].

What is striking about this case is that sovereignty over a state's territorial sea did not enter into the court's deliberation. Rather, the decision on the merits concluded that under international law innocent passage through a strait connecting open seas must be protected during times of peace[311]. Five judges dissented from the opinion.[312] All of them questioned the court's assignment of culpability to Albania based on very circumstantial evidence, yet only two judges – Judge Krylov[313] and Judge Azevedo[314] -- voted against the finding that Britain had not violated Albania's sovereignty by passing through the strait. At the same time, Britain's subsequent sweeping of mines in the strait was considered to be a violation of Albania's sovereignty.[315] One can question

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[307] *Corfu Channel Case (United Kingdom/Albania)* (Merits) [1949] ICJ Rep 4
[308] ibid 12-13
[309] ibid 22
[310] ibid 23 In 1946, the breadth of the territorial sea had not yet been agreed, but maps produced by Britain showed that the ships were indeed passing through an area that would be viewed as Albania's territorial sea. ibid 14
[311] ibid 28
[312] Judges Winiarski, Judge Badawi Pasha, Judge Krylov, Judge Azevedo and Judge ad hoc Ečer all dissented from the court's opinion. ibid 38
[313] ibid 73-6
[314] ibid 99
[315] ibid 36

whether the same ruling would apply today now that the territorial sea is regarded under LOSC as an extension of domestic territory, where sovereignty is unquestioned. During the time that the case was heard, Britain was still basking in the glory of being on the winning side of the Second World War and was instrumental in establishing both the UN and the ICJ. Whether the judges would have reached the same conclusions if another, less powerful, nation had aggressively sailed its warships into the territorial sea of another state can be debated. Nevertheless, in further support of the notion of transboundary good neighborliness, the *Corfu Channel Case* has come to represent a rule of international law that a nation cannot take measures that could harm another nation without giving warning of the possibility of damage.[316]

Trail Smelter, Nuclear Weapons and the *Corfu Channel Case* reflect limitations on exercises of sovereignty that will influence development of offshore freshwater, in that states must be cognizant of the environmental impact of their activities and must give prior notice of potentially harmful offshore actions. Harmful impacts from development of offshore freshwater could result from any of the activities listed early in this sub-chapter and could include injury to or death of marine species, seabed subsidence, and possibly tsunamis.

In one regional treaty, states have committed to giving notice of the potential for transboundary harm. In 1991 the UN Economic Commission for Europe (UNECE) adopted the Convention on Environmental Impact Assessment in a Transboundary Context[317], also known as the Espoo Convention. Originally open only to UNECE members, a group that includes most of Europe, Canada and the US, accession to the Espoo Convention was opened to all UN members in 2014.[318] The Espoo Convention obliges parties to 'prevent, reduce and control

[316] Franz Xaver Perrez, 'The Relationship Between "Permanent Sovereignty" and the Obligation Not To Cause Transboundary Environmental Damage' (1996) 26 Environmental Law 1187, 1199

[317] Convention on Environmental Impact Assessment in a Transboundary Context (adopted 25 February 1991, entered into force 10 September 1997) 1989 UNTS 309 (Espoo Convention)

[318] UN Economic Commission for Europe, 'Amendment to the Espoo Convention' (Decision II/14) (adopted 27 February 2001, entered into force on 26 August 2014)

significant adverse impact from proposed activities'[319] and also requires prior notice of this activity[320], public participation[321] and an environmental impact assessment (EIA)[322]. The list of activities that trigger compliance with the Espoo Convention include ''Groundwater abstraction activities in cases where the annual volume of water to be abstracted amounts to 10 million cubic metres or more'[323], which would probably include most if not all offshore aquifers. The Espoo Convention's 2003 Protocol on Strategic Environmental Assessment added water management to the scope of the treaty[324] and also introduced several additional triggering activities that would be relevant to offshore freshwater development: offshore hydrocarbon production[325], deep drilling for water supplies[326], and groundwater abstraction[327]. The parties to the 2003 Protocol agree to conduct a strategic environmental assessment (SEA) before initiation of the affected activities[328], to analyze the potential health impacts of the activities[329] and to ensure public participation[330].

Espoo directs its parties to produce an EIA according to the treaty specifications in Appendix II and to notify and consult with affected parties, but it does not prohibit significant transboundary harm.[331] Although the treaty has limited restrictions on state behavior, John Knox foresees obstacles to full global acceptance of Espoo, especially among developing countries that have lower

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319 Espoo Convention (n 317) art 2(1)
320 ibid art 3(1)
321 ibid art 2(6)
322 ibid art 2(2) Appendix II of Espoo lists the required elements of the environmental impact assessment.
323 ibid Appendix I, para 12
324 Protocol on Strategic Environmental Assessment to the Convention on Environmental Impact Assessment in a Transboundary Context (adopted 21 May 2003, entered into force 11 July 2010) 2685 UNTS 140, art 4(2)
325 ibid Annex I para 15
326 ibid Annex II para 20
327 ibid Annex II para 77
328 ibid art 4(2)
329 ibid art 5(1)
330 ibid art 8
331 John H Knox, 'Assessing the Candidates for a Global Treaty on Transboundary Environmental Impact Assessment' (2003) 12 New York University Environmental Law Journal 153, 162

domestic EIA standards that would have to be revised.[332] Nevertheless, parties to Espoo must comply with its procedural requirements where significant adverse transboundary effects may result from their activities[333]. In fact, while the Espoo EIA requirements are quite precise, production of an EIA where significant adverse transboundary effects may result from an activity is so common that the ICJ determined it to be an obligation under international law in both the *Pulp Mills Case* and its more recent 2015 ruling in the Costa Rica-Nicaragua dispute.[334] ITLOS extended the requirement to ABNJ, reasoning that natural resources in the Area are shared in the sense that they are CHM.[335]

Espoo sets the gold standard for how states must conduct themselves when the potential for transboundary harm is present, and Espoo parties with offshore freshwater resources must abide by its provisions. International law also has it own, more limited obligations that must be honored, and states desiring to develop offshore freshwater reserves must therefore notify the affected state if there is a potential for transboundary harm and must also conduct an EIA.

2.2.2 The Stockholm and Rio Declarations, Chapter 17 of Agenda 21 and the SDGs

Principle 21 of the Stockholm Declaration has been viewed as one of the seminal statements regarding the balance between environmental protection and sovereignty where transboundary harm may result from development activities. Adopted in 1972 when pervasive environmental degradation as a consequence

[332] ibid 165
[333] Simon Marsden, 'The Espoo Convention and Strategic Environmental Assessment Protocol in the European Union: Implementation, Compliance, Enforcement and Reform' (2011) 20 Review of European Community & International Environmental Law 267, 268
[334] *Pulp Mills on the River Uruguay (Argentina v. Uruguay)* (Judgment) (2010) ICJ Rep 14, para 204; *Certain Activities Carried Out by Nicaragua in the Border Area (Costa Rica v. Nicaragua)* and *Construction of a Road in Costa Rica along the San Juan River (Nicaragua v. Costa Rica)* (2015) (Judgment) ICJ Reports 665, para 153
[335] *Responsibilities and obligations of States with respect to activities in the Area* (Advisory Opinion) (2011) ITLOS Case No 17

of economic growth and population increase was becoming alarmingly apparent[336], Principle 21 consists of one concise sentence:

> States have, in accordance with the Charter of the United Nations and the principles of international law, the sovereign right to exploit their own resources pursuant to their own environmental policies, and the responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other States or of areas beyond the limits of national jurisdiction.[337]

Concern regarding transboundary harm is introduced with a caution for states to 'ensure' that they do not damage the environment of their neighbors. If an enforcement mechanism had been included, one could argue that Principle 21 established strict liability for such damage, since the prohibition uses the words 'do not' instead of 'should not'. Given the tradition of consensus that characterizes UN conferences, the most that one can confidently say is that the negotiating parties agreed that transboundary environmental damage should be avoided. The caution to avoid transboundary harm reflects the established norm of good neighborliness that resonated in *Trail Smelter* and the *Corfu Channel Case*. However, in light of the purpose of the Stockholm conference and its recommendations that focused on cooperation in the sphere of environmental protection, good neighborliness seems to have gone beyond the realm of nuisance avoidance and broadened into recognition that damage to a neighbor's environment can result in economic and social harm. In two resolutions passed six months after the Stockholm conference, the UNGA reinforced the messages of environmental protection, international cooperation and avoidance of 'significant harmful effects in zones situated outside their

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[336] *Silent Spring*, Rachel Carson's 1962 book that almost single-handedly launched the environmental movement, chronicles the devastating and wide-spread effects that wanton use of chemicals such as DDT were having on the environment in the 1950s. DDT was used as a pesticide to increase agricultural yields to feed growing populations. Rachel Carson, *Silent Spring* (40th anniversary edn, First Mariner Books 2002) 5-10

[337] 'Declaration of the United Nations Conference on the Human Environment', United Nations Conference on the Human Environment (Stockholm, 5-16 June 1972) UN Doc A/CONF.48/14/REV.1, p 3, Principle 21 (Principle 21 or Stockholm Declaration)

national jurisdiction', with specific reference to Principle 21.[338] According to Ayesha Diaz, Principle 21 marked the beginning of a global debate on balancing development with protection of the environment.[339]

Another outcome of Stockholm was to recommend that a second Conference on the Human Environment be convened.[340] Twenty years later, Rio de Janeiro hosted the UN Conference on Environment and Development, otherwise known as the Earth Summit, from the 3rd to the 14th of June 1992.[341] As the addition of the word 'development' to the title suggests, global attitudes to the environment had evolved significantly in twenty years. In the intervening years since the Stockholm Declaration was issued, initiatives such as the Charter on the Economic Rights and Duties of States (CERDS)[342] and the New International Economic Order (NIEO)[343] had been adopted and failed to change the economic status quo or to close the gap between developed and developing nations. The 1987 Brundtland Report[344], with its warning about the consequences of compromising the future in order to meet current needs, had ushered in the concept and the hope of sustainable development. By the time of the Earth Summit, very few colonies remained, UN membership had grown from 132 states in 1971 to 179 states in 1992[345] and human population had increased by forty-three percent from 3.8 billion to 5.5 billion[346], imposing enormous

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[338] UNGA Res 2994 (XXVII) (15 December 1972) and UNGA Res 2995 (XXVII) (15 December 1972)
[339] Diaz (n 305) 158
[340] 'Report of the United Nations Conference on the Human Environment', United Nations Conference on the Human Environment (Stockholm, 5-16 June 1972) UN Doc A/CONF.48/14/REV.1, p 32
[341] 'UN Conference on Environment and Development' (*Earth Summit).* <http://www.un.org/geninfo/bp/enviro.html> accessed 24 January 2018
[342] UNGA Res 3281 (XXIX) (12 December 1974)
[343] UNGA Res 3201 (S-VI) (1 May 1974) and UNGA Res 3202 (S-VI) (1 May 1974)
[344] World Commission on Environment and Development, *Our Common Future* (Oxford University Press 1987) ch I para 27 (Brundtland Report) *Our Common Future* is known as the Brundtland Report in recognition of the chair of the World Commission on Environment and Development, Gro Harlem Brundtland.
[345] 'Growth in United Nations membership, 1945-present' (*United Nations*) <http://www.un.org/en/sections/member-states/growth-united-nations-membership-1945-present/index.html> accessed 24 January 2018
[346] 'World population by year' (*Worldometers*). <http://www.worldometers.info/world-population/world-population-by-year/> accessed 24 January 2018

burdens on natural resources. According to the UN Earth Summit website, the main message in Rio was 'that poverty as well as excessive consumption by affluent populations place damaging stress on the environment.'[347] Thus, the two ends of the economic spectrum – poverty and affluence – were recognized as having a deleterious impact on the environment.

The Earth Summit produced some remarkable outcomes, including Agenda 21, the Rio Declaration on Environment and Development, the Statement of Forest Principles, the United Nations Framework Convention on Climate Change and the United Nations Convention on Biological Diversity.[348] However, in the discussions and drafting sessions leading up to the Earth Summit, a marked tension emerged when the developing countries perceived that environmental protection might be taking precedence over economic development.[349] For that reason, Principle 2 of the Rio Declaration on Environment and Development restates Stockholm's Principle 21 verbatim except for two words that added the concept of development:

> States have, in accordance with the Charter of the United Nations and the principles of international law, the sovereign right to exploit their own resources pursuant to their own environmental *and developmental* policies, and the responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other States or of areas beyond the limits of national jurisdiction.[350]

In Nico Schrijver's opinion, the fact that sovereignty over natural resources went from the twenty-first principle in the Stockholm Declaration to the second principle in the Rio Declaration is evidence of the heightened importance of the

[347] 'UN Conference on Environment and Development' (n 341)
[348] ibid
[349] Handl (n 306)
[350] 'Declaration of the United Nations Conference on the Human Environment' (n 337) Principle 2 (italics added)

issue to developing countries.[351] At the same time, Franz Xaver Perrez notes that some scholars have criticized the addition of the concept of development in Principle 2 of the Rio Declaration as proof that environmental protection has become subordinate to economic interests.[352] Other scholars viewed inclusion of development as a 'necessary reconciliation' between sustainable development and sovereignty over natural resources.[353] Looking at the pattern of continued exploitation of natural resources and pollution of the global commons, it would be difficult to disagree with a conclusion that economic priorities triumphed over environmental protection at the Earth Summit.

In the spirit of the Earth Summit, Agenda 21[354] was adopted as a nonbinding program for sustainable development. Although the Earth Summit took place two years before LOSC came into effect, Chapter 17 of Agenda 21 described LOSC as reflecting international law[355]. As an indication of the concerns regarding the marine environment, Chapter 17, with the cumbersome title of 'Protection Of The Oceans, All Kinds Of Seas, Including Enclosed And Semi-Enclosed Seas, And Coastal Areas And The Protection, Rational Use And Development Of Their Living Resources', has one hundred thirty-six paragraphs, significantly more than any of the other forty chapters of Agenda 21. The stated goal of Chapter 17 is 'to pursue the protection and sustainable development of the marine and coastal environment and its resources.'[356] The seven primary programs to achieve that goal include integrated management and sustainable development of coastal areas, marine environmental protection, sustainable use and conservation of marine living resources, climate change, and global and regional cooperation and coordination.[357] Among these programs, integrated coastal zone management (ICZM) would have the greatest potential to impact

[351] Nico Schrijver, *Sovereignty Over Natural Resources* (Cambridge University Press 1997) 136
[352] Perrez (n 316) 1203
[353] Patricia Birnie & Alan Boyle, *International Law and the Environment* (Oxford University Press 2002) 110
[354] 'Report of the UN Conference on Environment and Development' (12 August 1992) UN Doc. A/CONF.151/26 (Vol. II) Annex II
[355] ibid Ch 17, para 17.1
[356] ibid
[357] ibid

development of offshore freshwater, particularly where offshore aquifers are hydraulically connected to land-based aquifers. Promotion of ICZM was a primary focus of Chapter 17, and states were encouraged to establish national 'coordinating mechanisms' that addressed, among other things, 'water use and siting policies' and improvement of coastal drinking water and treatment.[358]

In 2012, twenty years after adoption of Agenda 21, the Division for Sustainable Development of the UN Department of Economic and Social Affairs produced an analysis of the effectiveness of each of the chapters of Agenda 21.[359] The scorecard for Agenda 21 generally[360] and for Chapter 17 and ICZM in particular indicated that implementation of the programs has been disappointing, and the condition of the oceans continues to decline.[361] At the regional level, policy frameworks have been adopted, but action at the local and national levels lags behind due to 'incompatibility of environmental, social and economic objectives' and 'low societal and political will' to undertake unpopular initiatives in order to ensure long-term sustainability.[362] Progress is further impeded by lack of coordination among various agencies and entities that are involved with ICZM.[363] The direct impact of the Stockholm and Rio Declarations and Agenda 21 on development of offshore freshwater would be difficult to measure, but the principles articulated in the non-binding efforts built on earlier agreed principles and have had incalculable influence on subsequent laws and treaties. In many ways, the Declarations and Agenda 21 blazed a trail and set milestones for later policymakers to follow in protecting the environment, and there is little doubt that their messages will continue to resonate for the foreseeable future.

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[358] ibid para 17.6

[359] Stakeholder Forum for a Sustainable Future, *Review of implementation of Agenda 21 and the Rio Principles: Detailed review of implementation of Agenda 21* (UN 2012) (*Detailed Review of Agenda 21*) The conclusions regarding fisheries will not be addressed herein.

[360] Stakeholder Forum for a Sustainable Future, *Review of implementation of Agenda 21 and the Rio Principles: Synthesis Report* (UN 2012) 8 See also Jennifer Devlin Calkins, 'Paris When It Sizzles: What Agenda 21 Can Tell Us about the Likely Success of the Paris Agreement' (2017) 27 Pacific Rim Law and Policy Journal 523, 559
(2017)

[361] *Detailed Review of Agenda 21* (n 359) 171

[362] ibid 170

[363] ibid 176

The most recent incarnation of the declarations and Agenda 21 can be found in the Sustainable Development Goals (SDGs), which were included in an outcome document adopted by the UNGA in 2015.[364] The outcome document, entitled 'Transforming our world: the 2030 Agenda for Sustainable Development', includes a series of seventeen goals that characterize UN development efforts through 2030. Among the goals are several that apply to marine activities and to freshwater. For example, Goal 14 desires to 'Conserve and sustainably use the oceans, seas and marine resources for sustainable development', and Goal 6 proposes to 'Ensure availability and sustainable management of water and sanitation for all'. Goal 3 is broad enough to encompass offshore freshwater and conservation of biodiversity: 'Ensure healthy lives and promote well-being for all at all ages.' At the time of this writing, implementation of the SDGs has barely begun, so assessment of their effectiveness would be premature. Nevertheless, scholars have already begun to analyze the potential impacts of the SDGs on both marine activities[365] and allocation of freshwater[366].

2.2.3 LOSC and the marine environment

The increased awareness of the need for environmental protection and preservation that arose in the 1960s and 1970s influenced the LOSC negotiators, and the drafters dedicated the forty-six articles of Part XII to protection of the marine environment. Chapter 17 of Agenda 21 elaborated on the obligations in draft Part XII, leading David Ong to reflect that the combination of Part XII and Chapter 17 together represents a significant step toward establishing protection of the marine environment as customary law.[367]

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[364] UNGA Res 70/1 (21 October 2015)

[365] Laura Recuero Virto, 'A preliminary assessment of the indicators for Sustainable Development Goal (SDG) 14 "Conserve and sustainably use the oceans, seas and marine resources for sustainable development"' (2018) 98 Marine Policy 47

[366] Otto Spijkers, 'The Cross-fertilization between the Sustainable Development Goals and International Water Law' (2016) 25 Review of European Community & International Environmental Law 39

[367] David Ong, 'The Next Step in Protection of Our Oceans?' (1992) 24 Marine Pollution Bulletin 583, 583

Part XII does not mention sustainability or sustainable use, but at the time that LOSC was drafted the concept of sustainability had not yet appeared in the lexicon of treaties addressing natural resources, since LOSC was adopted in 1982 and the Brundtland report would not appear until 1987.[368]

As a contribution to an analysis of LOSC thirty years after its adoption, Kristina Gjerde presented her views on the strengths and weaknesses of Part XII. Among the strengths are 'an overarching obligation for marine protection and preservation', coverage of all types of pollution, allowance for an evolutionary approach through other regimes and entities, a duty to cooperate globally and regionally, and mandates for assessment and monitoring of the environmental impacts of planned activities. The weaknesses she found include inadequate implementation of both the requirement for environmental protection and the duty to cooperate, a singular focus on pollution, a disjointed and fractured reaction to the evolutionary approach, a lack of common standards for environmental impact assessments in ABNJ and the absence of the precautionary principle and the ecosystem approach.[369]

The introductory article to Part XII, Article 192, declares that states 'have the obligation to protect and preserve the marine environment'.[370] In the *South China Sea Arbitration* between the Philippines and China, the Permanent Court of Arbitration Tribunal considered it 'well established' that Article 192 imposes 'a duty on States Parties the content of which is informed by the other provisions of Part XII and other applicable rules of international law.'[371] The Tribunal further explained the duty on states:

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[368] Brundtland Report (n 344)
[369] Kristina M Gjerde, 'Challenges to Protecting the Marine Environment' in David Freestone (ed) *The Law of the Sea Convention at 30: Successes, Challenges and New Agendas* (Martinus Nijhoff 2012) 168-71
[370] LOSC (n 180) art 192
[371] *In the Matter of the South China Sea Arbitration (Philippines v China)* (Award) (2016) PCA Case No 2013-19 (*South China Seas Arbitration)* para 941

> This "general obligation" extends both to "protection" of the marine environment from future damage and "preservation" in the sense of maintaining or improving its present condition. Article 192 thus entails the positive obligation to take active measures to protect and preserve the marine environment, and by logical implication, entails the negative obligation not to degrade the marine environment. . . . Thus States have a positive "'duty to prevent, or at least mitigate' significant harm to the environment when pursuing large-scale construction activities."[372]

In spite of the duty imposed on states, Article 193 reflects the dynamic tensions in balancing sovereignty, development, and environmental protection:

> States have the sovereign right to exploit their natural resources pursuant to their environmental policies and in accordance with their duty to protect and preserve the marine environment.[373]

As Kristina Gjerde recognized, Part XII places significant emphasis on pollution prevention and control. In fact, the primary environmental concern reflected in Part XII revolves around the effects of marine pollution.[374] Article 194 commands that states 'shall take . . . all measures . . . to prevent, reduce and control pollution of the marine environment'[375] and also mandates that states avoid transboundary effects from polluting activities[376]. Article 208 further requires states to take domestic action and to

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[372] ibid quoting *Indus Waters Kishenganga Arbitration (Pakistan v. India)*, Partial Award, 18 February 2013, PCA Award Series (2014), para. 451, quoting *Arbitration Regarding the Iron Rhine ("IJzeren Rijn") Railway between the Kingdom of Belgium and the Kingdom of the Netherlands, Award of 24 May 2005, PCA Award Series (2007), XXVII RIAA 35,* 66-67, para. 59

[373] LOSC (n 180) art 193

[374] ibid arts 195, 198-223, 234-5 Article 61-67 address fish stocks in the EEZ, Articles 116-120 address 'conservation and management of 'living resources of the high seas', and article 145 addresses protection of the marine environment in the Area. Since these articles do not expressly apply to protection of seabed natural resources, they will not apply to development of offshore freshwater resources and therefore will not be analyzed in this chapter.

[375] LOSC (n 180) art 194(1)

[376] ibid art 194(2) One writer has stated that Article 194(2) 'can be seen as an explicit although somewhat adapted copy of Stockholm Principle 21'. Johannes Fons Buhl, 'Development and

> adopt laws and regulations to prevent, reduce and control pollution of the marine environment arising from or in connection with seabed activities subject to their jurisdiction and from artificial islands, installations and structures under their jurisdiction.[377]

The applicability of these provisions to development of seabed natural resources such as offshore freshwater is obvious, and therefore any development of offshore freshwater in the jurisdiction of LOSC parties must be accompanied by pollution control measures. Article 208 requests that state-parties 'endeavour to harmonize their policies in this connection at the appropriate regional level' and further encourages them to 'establish global and regional rules, standards and recommended practices and procedures to prevent, reduce and control pollution' that may affect the seabed environment. If 'substantial pollution of or significant and harmful changes to the marine environment' is anticipated to result from planned events, then Article 206 requires the responsible party to assess the potential impact and publish the resulting reports. Since seabed activities will almost always necessitate advanced planning, an environmental impact assessment will have to be performed and communicated.[378] Where rare and fragile ecosystems are present, state-parties shall take measures to preserve and protect those ecosystems as well as 'the habitat of depleted, threatened or endangered species and other forms of marine life'.[379] These measures could include establishment of marine protected areas (MPAs)[380], which benefit from a wide variety of protective measures and management techniques that either limit or prohibit human activities[381].

Transfer of Marine Technology' in René-Jean Dupuy and Daniel Vignes (eds), *A Handbook on the New Law of the Sea, Vol 2* (Martinus Nijhoff 1991) 1217

[377] LOSC (n 180) art 208(1)

[378] Harrison (n 300) 212

[379] LOSC (n 180) art 194(5)

[380] Harrison (n 300) 213

[381] 'What are marine protected areas (MPAs)?' (*Protect Planet Ocean*) <http://www.protectplanetocean.org/collections/introduction/introbox/mpas/introduction-item.html> accessed 16 November 2018; 'Applying IUCN's Global Conservation Standards to

The concept of an MPA was born centuries ago in an effort to protect fisheries and was formalized in the 1970s through inclusion in the Convention on Wetlands (Ramsar Convention)[382], the World Heritage Convention[383] and the UNEP Regional Seas Programme and through the advocacy of the International Union for the Conservation of Nature (IUCN).[384] The geographic extent and breadth of obligations for MPAs varies widely, from no-take marine preserve zones to areas allowing controlled seabed development.[385] While there are approximately five thousand MPAs representing eight-tenths of a percent of the oceans[386], a 2012 global study revealed that MPAs are ineffective unless they have certain characteristics, such as no-take marine preserve zones, a large and protected geographical area and adequate enforcement[387]. Although the majority of MPAs are within national jurisdiction, many of them do not benefit from domestic legislation implementing the characteristics found to be effective. Approximately six percent of national waters have been designated as MPAs[388], which means that they are relatively easy to avoid. However, any planned development of offshore freshwater in a MPA will have to take into consideration the restrictions placed on activities in that area.

Marine Protected Areas (MPA)' (*IUCN WCPA* 2018) https://www.iucn.org/sites/dev/files/content/documents/applying_mpa_global_standards_final_version_050418.pdf accessed 5 December 2018

382 Convention on Wetlands (adopted 2 February 1971, entered into force 16 May 1976) 996 UNTS 245 (Ramsar Convention)

383 Convention for the Protection of the World Cultural and Natural Heritage (adopted 16 November 1972, entered into force 17 December 1975) 1037 UNTS 151, 27 UST 37; 11 ILM 1358

384 Committee on the Evaluation, Design, and Monitoring of Marine Reserves and Protected Areas in the United States, *Marine protected areas: tools for sustaining ocean ecosystems* (National Academy of Sciences 2001) 147-8

385 CBD Conference of the Parties, 'Decision VII/5: Marine and coastal biological diversity' (2004) UN Doc UNEP/CBD/COP/DEC/VII/5 (CBD Decision VII/5) para 21

386 'Global facts about MPAs and marine reserves' (*Protect Planet Ocean*) < http://www.protectplanetocean.org/collections/introduction/introbox/globalmpas/introduction-item.html> accessed 17 November 2018

387 Piers K Dunstan and others, 'Using ecologically or biologically significant marine areas (EBSAs) to implement marine spatial planning' (2016) 121 Ocean and Coastal Management 116, 117

388 'Explore the World's Marine Protected Areas' (*Protected Planet* 2018) <https://www.protectedplanet.net/marine> accessed 5 December 2018

Although ITLOS has opined that 'the conservation of the living resources of the sea is an element in the protection and preservation of the marine environment'[389], Rüdiger Wolfrum and Nele Matz have observed that LOSC does not provide guidance for management and conservation of sedentary species found in the EEZ Seabed and the OCS[390]. The void left by LOSC has been filled by judicial opinions, by other multilateral treaties such as the Convention on Biological Diversity and by the Regional Seas Programme that will be discussed later in this chapter.

In 2011 ITLOS issued an advisory opinion regarding state obligations to protect the environment during deep seabed mining activities in the Area beyond national jurisdiction, and that opinion could be influential for designing governance regimes for activities in the continental shelf within national jurisdiction.[391] The tribunal first defined 'activities in the Area' to include

> drilling, dredging, coring, and excavation; disposal, dumping and discharge into the marine environment of sediment, wastes or other effluents; and construction and operation or maintenance of installations, pipelines and other devices related to such activities.[392]

According to ITLOS, activities in the Area also include 'ship-board processing immediately above a mine site of minerals derived from that mine site'[393] as well as 'recovery of minerals from the seabed and their lifting to the water surface'[394]. In light of state responsibilities under LOSC, ITLOS held that the

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[389] *Order of 27 August 1999, Southern Bluefin Tuna Cases (New Zealand v. Japan; Australia v. Japan), Requests for Provisional Measures* (Order of 27 August 1999) ITLOS Cases Nos. 3 and 4, 38 International Legal Materials 1624, 1634 para 70

[390] Rüdiger Wolfrum and Nele Matz, 'The Interplay of the United Nations Convention on the Law of the Sea and the Convention on Biological Diversity' (2000) Max Planck Yearbook of United Nations Law 445, 452, 454

[391] *Responsibilities and obligations of States with respect to activities in the Area* (Advisory Opinion) (2011) ITLOS Case No 17, para, 10

[392] ibid para 87

[393] ibid para 88

[394] ibid para 94

state sponsoring the contractor has clear obligations with respect to protection of the environment during activities in the Area:

> the obligation to assist the Authority in the exercise of control over activities in the Area; the obligation to apply a precautionary approach; the obligation to apply best environmental practices; the obligation to take measures to ensure the provision of guarantees in the event of an emergency order by the Authority for protection of the marine environment; the obligation to ensure the availability of recourse for compensation in respect of damage caused by pollution; and the obligation to conduct environmental impact assessments.[395]

However, the tribunal also stated that a state's obligation was one 'of conduct' and not 'of result'[396], that the 'sponsoring State is not . . . liable for the failure of the sponsored contractor to meet its obligations'[397]. In order for the sponsoring State's liability to arise, there must be a causal link between the failure of that State and the damage caused by the sponsored contractor'[398]. From ITLOS's advisory opinion, one can conclude that states have clear due diligence obligations to take steps to protect the marine environment during mining activities in the Area, but their responsibilities and liability are limited to engaging in proper conduct without guaranteeing protection of the environment.

The ICJ reconfirmed recently in the Costa Rica-Nicaragua dispute that the obligation of due diligence also extends to activities in national jurisdiction.[399] In order to meet this obligation, states must determine prior to undertaking a potentially harmful activity whether there is a risk of significant transboundary

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[395] ibid oara 122
[396] ibid para 110
[397] ibid para 172 This principle was reaffirmed in the *South China Seas Arbitration* (n XX) para 944
[398] ibid para 181
[399] *Certain Activities Carried Out by Nicaragua in the Border Area (Costa Rica v. Nicaragua)* and *Construction of a Road in Costa Rica along the San Juan River (Nicaragua v. Costa Rica)* (2015) (Judgment) ICJ Reports 665, para 153

harm from that activity. At a minimum, the state must conduct an EIA, share its results with the potentially affected party and enter into consultations to discuss the best way forward. The due diligence obligation does not translate into an obligation to forego the harmful activity, and the state is not required to guarantee a result acceptable to its neighbor. Hence, the obligations are procedural and not substantive, although the goal is that consultations will lead to an agreed outcome. Should significant harm nonetheless occur, the aggrieved party may seek damages, a remedy that was once again confirmed by the ICJ in 2018.[400] The procedural due diligence obligations will apply to development of offshore freshwater resources as well should the risk of significant harm be anticipated. As stated earlier and as described more fully in Chapter 4.4, the risks of significant transboundary harm arising from offshore freshwater development could include not only long-lasting and lethal impacts on seabed habitats, but also subsidence of the continental shelf seabed and the remote possibility of shelf collapse leading to tsunamis. The potential for such grave impacts must be taken into account in the early stages of planning, must be addressed in the EIA and should be factored into the financial analysis supporting the project.

Recently, the ISA has been taking steps to provide guidance on protection of the marine environment during deep seabed mining in the Area[401] while also producing draft regulations for exploitation of minerals in the Area[402]. Once again, these analyses may prove to be influential in areas of national jurisdiction as well. The draft regulations provide for public disclosure of the environmental impact statement, the environmental management and monitoring plan and the site closure plan that must be submitted with a plan of work for development[403], as well as requiring an environmental performance

[400] *Certain Activities Carried Out by Nicaragua in the Border Area (Costa Rica v. Nicaragua)* and *Construction of a Road in Costa Rica along the San Juan River (Nicaragua v. Costa Rica)* (2018) (Judgment) 2 February 2018 General List No. 150, para 42
[401] ISA EMP for Clarion-Clipperton Zone (n 276); ISA Council EMP Decision (n 276)
[402] ISA Draft Exploitation Regulations (n 278)
[403] ibid Draft regulation 11

guarantee from the selected contractor[404]. Offshore freshwater is not expected to be located in the Area, but the ISA guidelines may still be persuasive for future extraction of seabed resources such as methane hydrates that lie within the OCS. Meanwhile, a debate continues on the extent and structure of environmental protection during deep seabed mining in the Area[405] and whether deep seabed mining should take place at all[406]. Criticism of the ISA's inaction in mounting, and Aline Jaeckel has concluded that

> the ISA lacks strategic vision regarding the environmental management of seabed mining. At present all protective measures are adopted on an ad hoc basis and environmental standards are set incrementally, making them vulnerable to being disregarded particularly if commercial pressure to commence the exploitation phase increases.[407]

2.2.4 Regional Seas Programme

Part XII of LOSC requires global and regional cooperation 'in formulating and elaborating international rules, standards and recommended practices and procedures'.[408] As noted above, state-parties are further obligated to 'establish global and regional rules, standards and recommended practices' specifically devoted to protecting the seabed environment[409] and are required to 'adopt laws and regulations and take other measures necessary to implement

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[404] ibid Draft regulation 27
[405] Michael Lodge and others (n 404); Jennifer M Durden and others, 'A procedural framework for robust environmental management of deep-sea mining projects using a conceptual model' (2017) 84 Marine Policy 193; Jeff A Ardrona, Henry A Ruhl and, Daniel OB Jones, 'Incorporating transparency into the governance of deep-seabed mining in the Area beyond national jurisdiction' (2018) 89 Marine Policy 58; Luc Cuyvers and others, *Deep seabed mining; A rising environmental Challenge* (International Union for the Conservation of Nature 2018); Jennifer M Durden, 'Environmental Impact Assessment process for deep-sea mining in 'the Area'' (2018) 87 Marine Policy 194
[406] Rakhyun E Kim, 'Should deep seabed mining be allowed?' (2017) 82 Marine Policy 134; CL van Dover, 'Scientific rationale and international obligations for protection of active T hydrothermal vent ecosystems from deep-sea mining; (2018) 90 Marine Policy 20
[407] Aline L Jaeckel, *The International Seabed Authority and the Precautionary Principle* (Brill 2017) 308
[408] LOSC (n 180) art 197
[409] ibid art 208(5)

applicable international rules and standards'[410]. The regional rules and recommended practices suggested by LOSC were indeed implemented and began in advance of LOSC. In 1974, during a time when LOSC was being negotiated, the UN Environmental Programme initiated the Regional Seas Programme (RSP).[411] While its original mission was to reduce pollution through cooperation on a regional basis, the RSP took on a broader role as the environmental impact of oceanic activities became more wide-spread and complex.[412] Presently, the RSP encompasses eighteen regions and one hundred forty-three countries[413] and has three classes of programmes: wholly independent programmes, programmes administered by UNEP, and affiliated programmes not administered by UNEP[414]. After the inaugural treaty addressing the Mediterranean Sea (known as the Barcelona Convention) was opened for signature in 1976[415], multilateral agreements followed for the Kuwait Region (also called the ROPME Sea Region)[416], the Antarctic[417], West and Central Africa[418], the South-East Pacific[419], the Red Sea and the Gulf of Aden

[410] ibid art 214
[411] Nilufer Oral, 'Forty Years of the UNEP Regional Seas Programme: from past to future' in Rosemary Rayfuse (ed), *Research Handbook on International Marine Environmental Law* (Edward Elgar Publishing 2015) 339, 339
[412] ibid
[413] 'Background, Regional Seas' (UN Environment) <http://drustage.unep.org/regionalseas/who-we-are/background> accessed 13 January 2018
[414] Oral (n 411) 345-7
[415] Convention for the protection of the Mediterranean Sea against pollution (Barcelona Convention) (signed 16 February 1976, entered into force 12 February 1978) 1102 UNTS 27, 15 ILM 290; Protocol for the Protection of the Mediterranean Sea against Pollution Resulting from Exploration and Exploitation of the Continental Shelf and the Seabed and its Subsoil (adopted on 14 October 1994, entered into force 17 March 2011) The original Barcelona Convention was replaced by the 1995 Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean (adopted 10 June 1995, entered into force 9 July 2004) 1102 UNTS 27 (Revised Barcelona Convention).
[416] Kuwait Regional Convention for Co-Operation on the Protection of the Marine Environment from Pollution (adopted 24 April 1978, entered into force 30 June 1979) 1140 UNTS 133
[417] Convention on the Conservation of Antarctic Marine Living Resources (adopted 20 May 1980, entered into force 7 April 1982) 1329 UNTS 47
[418] Convention for the Protection, Management and Development of the Marine and Coastal Environment of the West and Central African Region adopted 23 March 1981, entered into force 5 August 1984) 20 ILM 746
[419] Convention for the Protection of the Marine Environment and Coastal Area of the South-East Pacific (Lima Convention) (adopted 12 November 1981, entered into force 19 May 1986) 1648 UNTS 3 (Lima Convention)

(also known as the Jeddah Convention)[420], the Wider Caribbean Region[421], the South Pacific (known as the Noumea Convention)[422], Eastern Africa[423] the Baltic Sea[424] the Black Sea[425] the North-East Atlantic (also known as OSPAR)[426], and the Northeast Pacific (known as the Antigua Convention)[427].

The path to an agreement on regional seas generally begins with a transboundary diagnostic analysis and continues with a strategic action plan and a programme of work before treaty negotiations begin.[428] Most of the treaties follow a similar pattern and contain promises to take appropriate measures to protect the marine environment, but with varying effect. While OSPAR led to a ban on oil-based mud cuttings in offshore hydrocarbon drilling[429] and elimination of synthetic-based mud cuttings in the North Sea[430], in the opinion of Nilufer Oral regulatory regimes for offshore activities remain generally weak[431].

Although the legal protections afforded to the marine environment may be less than ideal, they still represent an interest in preserving ecosystems from

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[420] Regional Convention for the Conservation of the Red Sea and of the Gulf of Aden Environment (adopted 14 February 1982, entered into force 20 August 1985)
[421] Convention for the Protection and Development of the Marine Environment of the Wider Caribbean Region (adopted 24 March 1983, entered into force 11 October 1986) TIAS 11085; 1506 UNTS 157
[422] Convention for the Protection of the Natural Resources and Environment of the South Pacific Region (adopted 24 November 1986, entered into force 22 August 1990) 26 ILM 38
[423] Convention for the Protection, Management and Development of the Marine and Coastal Environment of the Eastern African Region (adopted 21 June 1985, entered into force 29 May 1996) 1986 OJ C253, 10
[424] Convention on the Protection of the Marine Environment in the Baltic Sea Area (Helsinki Convention) (adopted 9 April 1992, entered into force 17 January 2000) 2099 UNTS 195
[425] Convention on the Protection of the Black Sea Against Pollution (adopted 21 April 1992, 15 January 1994) 1764 UNTS 3, 32 ILM 1101
[426] Convention for the Protection of the Marine Environment of the North-East Atlantic (adopted 22 September 1992, entered into force 25 March 1998) 2354 UNTS 67; 32 ILM 1069 (OSPAR)
[427] Convention for Cooperation in the Protection and Sustainable Development of the Marine And Coastal Environment of the Northeast Pacific (Antigua Convention) (adopted 18 February 2002, not yet entered into force)
[428] Oral (n 411) 347
[429] Torgeir Bakke, 'Environmental impacts of produced water and drilling waste discharges from the Norwegian offshore petroleum industry' (2013) 92 Marine Environmental Research 154, 155
[430] ibid 161
[431] Oral (n 411) 358

damage and destruction arising from human activities. In some ways, one could view the RSP as the progeny of *Trail Smelter* and *Nuclear Weapons,* in that states have willingly limited their sovereignty in order to take actions to protect a fragile and vital marine environment. In this way, legal principles that arose for land-based environmental protection migrated to the sea, and the result is greater synergy and harmony in international environmental law.

The first treaty of the RSP still sets the highest standard for environmental management of a regional, shared marine body. The Barcelona Convention consists of the convention, the 1995 Action Plan for the Protection of the Marine Environment and the Sustainable Development of the Coastal Areas of the Mediterranean, and seven protocols[432] and aims to protect and preserve the environmental integrity of the Mediterranean Sea. The Mediterranean faces a double threat through having twenty-three countries[433] and a number of islands aligning its shores and also being an enclosed sea with only three narrow straits (Gibraltar, Dardanelles and Bosporus) and the artificial Suez Canal allowing limited flows to refresh the waters. The presence of aquifers in the Mediterranean is entirely possible, and scientists recently postulated that large quantities of methane hydrates may also be present[434]. Therefore, any development of offshore freshwater resources in the Mediterranean would have

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[432] Three of the protocols are relevant to this thesis: Protocol for the Protection of the Mediterranean Sea against Pollution Resulting from Exploration and Exploitation of the Continental Shelf and the Seabed and its Subsoil (adopted 14 October 1994, entered into force 24 March 2011) (Barcelona Seabed Protocol); Protocol concerning Specially Protected Areas and Biological Diversity in the Mediterranean (adopted 10 June 1995, entered into force 12 December 1999) (Barcelona Biodiversity Protocol), and Protocol on Integrated Coastal Zone Management in the Mediterranean (adopted 21 January 2008, entered into force 24 March 2011) (Barcelona ICZM Protocol). Other protocols are the Dumping Protocol (from ships and aircraft), the Prevention and Emergency Protocol (pollution from ships and emergency situations), the Land-based Sources and Activities Protocol and the Hazardous Wastes Protocol. 'The Barcelona Convention' (*European Commission,* 8 June 2016) <http://ec.europa.eu/environment/marine/international-cooperation/regional-sea-conventions/barcelona-convention/index_en.htm> accessed 13 November 2018

[433] Albania, Algeria, Bosnia-Herzegovina, Croatia, Cyprus, Egypt, France, Greece, Israel, Italy, Lebanon, Libya, Malta, Monaco, Montenegro, Morocco, Palestine, Slovenia, Spain, Syria, Tunisia, Turkey and the United Kingdom (through Gibraltar and the two Sovereign Base Areas of Akrotiri and Dhekelia on the island of Cyprus).

[434] Şükrü Mereya and Sotirios Nik. Longinos, 'Does the Mediterranean Sea have potential for producing gas hydrates?' (2018) 55 Journal of Natural Gas Science and Engineering 113, 129

to conform to the rules and regulations of the Barcelona system. Other states wishing to enhance their own RSPs may adopt some of the principles and practices of the Barcelona system, so a quick summary of the convention and its relevant protocols would be instructive.

The Barcelona Convention is a framework convention whose implementation is achieved through protocols.[435] Since the revised convention was adopted only a few years after the Earth Summit in 1992, it advocates the themes that emanated from Rio: sustainable development[436], the precautionary principle[437], the polluter pays principle[438], EIAs prior to activities that could cause significant harm[439], integrated coastal zone management[440], utilization of best available techniques and best environmental practices[441], and implementation of environmentally sound technology.[442] The parties commit to 'take all appropriate measures to prevent, abate, combat and to the fullest possible extent eliminate pollution' arising from exploration and exploitation activities on the continental shelf[443] and to preserve and protect biodiversity through individual and joint actions[444].

The protocol to the Barcelona Convention that adds texture to obligations regarding seabed activities applies to all seabed mineral resources in whatever form[445] and covers scientific research, exploration and exploitation[446] as well as installations[447]. Significantly, the parties agree to deny authorization for proposed activities if there are 'indications' that the activities are 'likely to cause

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435 Tullio Scovazzi, 'International Cooperation as Regards Protection of the Environment and Fisheries in the Mediterranean Sea' (2018) 34 Anuario Espanol de Derecho Internacional 301, 306
436 Revised Barcelona Convention (n 415) art 4(1)
437 ibid art 4(3)(a)
438 ibid art 4(3)(b)
439 ibid art 4(3)(c)
440 ibid art 4(3)(e)
441 ibid art 4(4)(b)
442 ibid
443 ibid art 7
444 ibid art 10
445 Barcelona Seabed Protocol (n 432) art 1(c)
446 ibid art 1(d)
447 ibid art 1(f)

significant adverse effects on the environment'.[448] The protocol provides an agreed list of information that must accompany any application for seabed activities[449] and calls on the parties to 'adopt common standards for the use and disposal of drilling fluids and drilling cuttings'[450]. Transboundary pollution should be avoided by using 'all measures necessary', and parties agree to give immediate notification to affected parties if there is a threat of imminent danger to the marine environment.[451]

The protocol that addresses protection of biodiversity[452] specifically includes 'the seabed and its subsoil' in its scope[453] and calls on parties to preserve and protect 'threatened or endangered species'[454], to establish 'specially protected areas'[455] and to 'cooperate . . . in the conservation and sustainable use of biological diversity'[456] while adopting 'strategies, plans and programmes for the conservation of biological diversity'[457]. To this end, the protocol provides for establishment of 'Specially Protected Areas of Mediterranean Importance', or SPAMIs[458] which serve to conserve 'components of biodiversity', contain Mediterranean ecosystems and endangered species habitats, and/or have special 'scientific, aesthetic, cultural or educational' interest[459]. Once an area has been approved by consensus for SPAMI designation, all parties to the protocol agree to abide by the protections described in the proposal for inclusion.[460] Three annexes to the protocol provide the criteria for designation and lists of species to be protected. To date, the parties have approved thirty-

[448] ibid art 4(2)
[449] ibid art 5
[450] ibid art 10(2)
[451] ibid art 26
[452] Barcelona Biodiversity Protocol (n 432)
[453] ibid art 2(1)
[454] ibid art 3(1)(b)
[455] ibid art 3(1)(a)
[456] ibid art 3(2)
[457] ibid art 3(4)
[458] ibid art 8(1)
[459] ibid art 8(2)_
[460] 'SPAMIs' (*RAC/SPA*) <http://www.rac-spa.org/spami> accessed 13 November 2018

five SPAMIs in the coastal waters of nine states,[461] some of which may contain offshore freshwater.

In 2008 the parties to the Barcelona Convention adopted another protocol in order to implement their commitments to initiate integrated coastal zone management (ICZM). The protocol defines the coastal zone as extending from the outer limit of the territorial sea to a landward 'limit of the competent coastal units'.[462] Among the stated objectives of ICZM are rational planning to facilitate sustainable development[463], preservation of coastal zones for future generations[464] and sustainable use of water resources[465]. To support sustainable use of freshwater, the parties agree to 'ensure respect for integrated water resources management'[466] and 'to monitor coastal aquifers'[467]. Special protection for wetlands is also included in the protocol[468], although nine parties to the Barcelona Convention are already members of the Ramsar Convention[469]. Development of the regional ICZM approach continues, and at their 2017 Conference of the Parties the parties to the Barcelona Convention adopted a 'General Structure and Elements of the Common Regional Framework for ICZM and Timetable of its Preparation'.[470]

ICZM is one incarnation of a philosophy called integrated ocean management (IOM), whose components are an ecosystem-based approach, the precautionary

[461] ibid SPAMIs may also be designated in the high seas areas and in un-delimited areas, but in that case two or more neighboring states must submit the proposal. Barcelona Biodiversity Protocol (n 432) art 9(2)(b)
[462] Barcelona ICZM Protocol (n 432) art 3(1)
[463] ibid art 5(a)
[464] ibid art 5(b)
[465] ibid art 5(c)
[466] ibid art 9(c)
[467] ibid art 9(2)(e)(iii)
[468] ibid art 10(1)
[469] Those nine countries are Albania, Cyprus, France, Greece, Italy, Malta, Montenegro, Slovenia and Spain.
[470] Contracting Parties to the Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean and its Protocols, 'Report of 20th Ordinary Meeting', (17-20 December 2017) UN Doc UNEP(DEPI)/MED IG.23/23, Decision IG.23/7, Annex I

principle, EIAs and spatial planning that may include MPAs.[471] Although IOM of living resources was the most contentious issue in the Chapter 17 negotiations[472], in the end IOM was identified in Chapter 17 of Agenda 21 as 'a key tool for promoting sustainable development of the ocean and protection of the marine environment'.[473] More than thirty states are involved in designing or implementing IOM, and on a regional level the concept is most developed in Europe[474], with the Barcelona system for the Mediterranean Sea as a prime example. Instead of utilizing ICZM, the treaties for the Baltic Sea (Helsinki Convention) and the North-East Atlantic (OSPAR) exhibit a different regional approach to IOM by focusing more on marine spatial planning where multiple activities compete for the same space. IOM seems to be on the cutting edge of the evolutionary approach to ocean governance, but its full acceptance may still be decades away.

In the Baltic Sea, the Helsinki Commission (HELCOM) has established[475] one hundred seventy-six MPAs[476], whose goal is to 'protect valuable marine and coastal habitats.[477] The Baltic MPAs sometimes cover the same area as the EU MPA network called Natura 2000 and also overlap with at least one OSPAR MPA[478], presenting obvious legal complexities for developers of offshore freshwater in the area. Parties to the Helsinki Convention agree to 'take all appropriate legislative, administrative or other relevant measures to prevent and eliminate pollution'[479], to 'apply the precautionary principle'[480], to conduct

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[471] Karen M Scott, 'Integrated Oceans Management' in Donald R Rothwell and others (eds), *The Oxford Handbook of the Law of the Sea* (Oxford University Press 2015) 467
[472] Mark F Forst, 'The convergence of Integrated Coastal Zone Management and the ecosystems approach' (2009) 52 Ocean and Coastal Management 294, 295-6
[473] ibid 465
[474] ibid
[475] HELCOM, 'System of coastal and marine Baltic Sea protected areas' (1994) Recommendation 15/5
[476] 'Marine Protected Areas' (*HELCOM* 2018) <http://www.helcom.fi/action-areas/marine-protected-areas> accessed 14 November 2018
[477] Janice Borg, Jan Ekebom and Penina Blankett, *Overview of the status of the network of Baltic Sea marine protected areas* (HELCOM 2013) 7
[478] ibid 8
[479] Helsinki Convention (n 424) art 3(1)
[480] ibid art 3(2)

EIAs[481], and 'to prevent pollution of the marine environment of the Baltic Sea Area resulting from exploration or exploitation of its part of the seabed and the subsoil'[482]. As an example of collaboration among international organizations, HELCOM utilizes the management categories of MPAs that were produced by the IUCN.[483] The IUCN categories range from strict nature reserves allowing limited human activity (no-take zones) to protected areas allowing non-industrial sustainable utilization of natural resources.[484]

Although OSPAR parties have designated four hundred fifty-five MPAs, mostly in territorial seas, the OSPAR website admits that the system is not 'ecologically coherent'.[485] However, due to the intensity of offshore hydrocarbon development in its region, OSPAR contains precise provisions regarding protection of the environment from offshore activities. Article 5 incorporates the provisions of Annex III, where the parties agree to use 'best available techniques and best environmental practice, including, where appropriate, clean technology'[486] to prevent and eliminate pollution from offshore sources, to prohibit dumping of wastes from offshore installations[487] and to regulate disused offshore structures and equipment[488]. Annex V of OSPAR also contains provisions relating to protection and conservation of marine ecosystems and biodiversity, with a specific mention of the parties' obligations under the CBD 'to develop strategies, plans or programmes for the conservation and sustainable use of biological diversity'.[489] The OSPAR parties have added texture to the treaty through decisions and recommendations. One series of recommendations that may be applicable for offshore freshwater development

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481 ibid art 7
482 ibid art 12
483 Borg, Ekebom and Blankett (n 477) 10
484 Nigel Dudley (ed), *Guidelines for Applying Protected Area Management Categories* (IUCN 2008) 4
485 'Status of the OSPAR Network of Marine Protected Areas in 2017' (*OSPAR Commission*) <https://www.ospar.org/site/assets/files/1378/assessment_sheet_mpa_status_2017.pdf> accessed 14 November 2018
486 OSPAR (n 426) Annex III, art 2(1)
487 ibid Annex III, art 3(1)
488 ibid Annex III, arts 5,7,8
489 ibid Annex V, art 2

concerns disposal of the chemical-laden produced water that accompanies seabed drilling, drilling that heretofore has focused on hydrocarbons.[490] Offshore aquifers will obviously require drilling, and the drilling rigs will utilize water for their operations. Contractors drilling into offshore aquifers will have to be aware of and abide by the applicable laws and regulations regarding disposal, which could include injection of produced water into the seabed and use of state of the art water treatment techniques.[491]

No one international institutional governs all seabed activities[492], and states that participate in RSPs face a dizzyingly complex array of national, bilateral, regional and global legal obligations designed to protect the environment while at the same time enabling sustainable development of natural resources. National laws of individual states are beyond the scope of this thesis, but certain bilateral agreements that address development of offshore natural resources are highlighted in Chapter 4. This section listed the various multilateral treaties that have grown out of the RSP, with special emphasis on three European regional agreements whose parties also must abide by EU regulations. Underlying and supporting all of these undertakings and obligations are the provisions of LOSC and the CBD.

2.2.5 The Convention on Biological Diversity

The Convention on Biological Diversity (CBD), which includes marine ecosystems in its definition of biodiversity[493], has become an increasingly robust tool for protection of the marine environment both in national water and in ABNJ. Through their commitments in the CBD, states agree to take actions within their sovereign domains to conserve biodiversity. As discussed above,

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[490] OSPAR, 'Management of Produced Water from Offshore Installations' (2001) Recommendation 2001/1, as amended by OSPAR Recommendations 2006/4 and 2011/8; OSPAR, 'A risk-based approach to management of produced water discharges from offshore installations' (2012) Recommendation 2012/5

[491] ibid

[492] Harrison (n 300) 214

[493] CBD (n 182) art 2

the fragmented sectoral approach to governing seabed activities[494] has led to multiple organizations issuing separate sets of guidance for protecting the marine environment.[495] Even though exploration and exploitation of offshore hydrocarbon has exacted the most pervasive environmental impacts on the seabed[496], according to at least one commentator international law protecting the marine environment from offshore hydrocarbon activities lags far behind the regimes protecting the environment from shipping activities.[497] Nengye Liu argues that the CBD 'is therefore the most relevant international legal instrument for protection of marine biodiversity from offshore oil and gas activities'[498]. Estelle Victoria Jones and others support this viewpoint, observing that the CBD is the 'overarching framework for stemming and reversing' the trend of marine biodiversity loss, by allowing states to determine for themselves how to meet the convention's overall goals.[499] Rüdiger Wolfrum and Nele Matz agree, saying that in contrast to LOSC, the CBD 'aims at comprehensive long term efforts that protect all components of biological diversity and not only those that are momentarily considered valuable'.[500] The CBD can thus be viewed as working in harmony with the provisions of LOSC that mandate protection of the marine environment. Since development activities for offshore freshwater will be similar, if not identical, to hydrocarbon development activities, application of CBD to offshore freshwater activities will follow application to offshore hydrocarbon activities.

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494 Harrison (n 300) 243

495 For example, the Food and Agriculture Organization has issued guidance in connection with fisheries, and the International Maritime Organization has provided the same service for the shipping sector. Ibid 275

496 The environmental impacts of offshore hydrocarbon development are summarized in Chapter 4.4.

497 Nengye Liu, 'Protection of the marine environment from offshore oil and gas activities' in Rosemary Rayfuse (ed), *Research Handbook on International Marine Environmental Law* (Edward Elgar Publishing 2015) 190, 192

498 ibid 193

499 Estelle Victoria Jones and others, 'A comparative analysis of three marine governance systems for implementing the Convention on Biological Diversity (CBD)' (2016) 66 Marine Policy 30, 31

500 Wolfrum and Matz (n 390) 464

The primary impacts of the CBD on marine activities arise through the broad scope of the convention, through its implementation in domestic legal regimes and through the influence of its program for Ecologically or Biologically Significant Marine Areas (EBSAs).[501] EBSAs were originally designed to support designation of MPAs in ABNJ[502], and their influence was subsequently extended to areas within national jurisdiction[503]. With respect to the scope of the convention, Article 5 of the CBD clarifies that the provisions of the convention apply to 'components of biodiversity' within the boundary of each state-party's national jurisdiction[504] as well as to 'processes and activities' under a state-party's jurisdiction or control no matter where those processes and activities may take place[505]. Thus, states are obligated to safeguard biodiversity both within their own terrestrial and maritime borders and to manage activities in ABNJ that are under their jurisdiction and control and that could have an impact on biodiversity.

Due to its expansive scope, the CBD applies to offshore freshwater reserves that are within the national jurisdictions of treaty parties and to activities relating to freshwater in ABNJ. The provisions of the CBD would extend to conservation of flora and fauna that are affected by both exploration and exploitation of offshore freshwater reserves. Those flora and fauna may include species that form part of the ecosystem provided by offshore aquifers and by methane hydrates. As noted in Chapter 1.2.2, various types of microorganisms have been found dwelling in land-based aquifers, and one can logically conclude that microorganisms will likewise dwell in seabed aquifers. In addition, Chapter 1.2.3 mentioned that methane hydrates serve as the basis of ecosystems where hydrocarbon-loving bacteria and invertebrates such as ice-worms thrive.

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501 Daniel C Dunn and others, 'The Convention on Biological Diversity's Ecologically or Biologically Significant Areas: Origins, development, and current status' (2014) 49 Marine Policy 137, 142

502 ibid 138

503 Andrew Friedman, 'Submarine Telecommunication Cables and a Biodiversity Agreement in ABNJ: Finding New Routes for Cooperation' (2017) The International Journal of Marine and Coastal Law 1, 12

504 CBD (n 182) art 5(a)

505 ibid art 5(b)

Further, since its 2004 call for marine and coastal protected areas, the CBD has recognized the interaction between marine and coastal activities,[506] and those provisions would affect offshore aquifers that are hydraulically connected to land-based aquifers.

The EBSA program was adopted by the CBD in 2008[507] and complements but does not replace programs adopted by other organizations. For example, the Food and Agriculture Organization recognizes Vulnerable Marine Ecosystems to protect against overfishing and bottom trawling[508], the International Maritime Organization recognizes Particularly Sensitive Sea Areas to guard against environmental damage from the shipping industry[509], and the International Seabed Authority has designated Areas of Particular Environmental Importance in the Clarion-Clipperton Zone.[510]. In spite of the plethora of protective mechanisms, there is no cross-sectoral application, leaving gaps in coverage. For instance, a ban on fishing in a VME will not prohibit hydrocarbon development in the VME.

While designation of an EBSA has no legal effect on CBD state-parties, the scientific rigor that accompanies those designations has far-reaching influence through informing national marine protection programs and influencing MPA selection.[511] The 2008 CBD Conference of the Parties (COP) listed the 'Scientific

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506 CBD (2004) Decision VII/5 (n 385)

507 CBD Conference of the Parties, 'Decision IX/20; Marine and coastal biodiversity' (2008) UN Doc UNEP/CBD/COP/DEC/IX/20 (CBD Decision IX/20), para 14, Annex I

508 FAO, *International Guidelines for the Management of Deep-sea Fisheries in the High Seas* (FAO 2009)

509 IMO, *Revised Guidelines For The Identification And Designation Of Particularly Sensitive Sea Areas,* IMO Res A.982(24) (1 December 2005)

510 ISA Council EMP Decision (n 276) In addition, scholars have introduced the concept of other effective area-based conservation measures (OECMs) that function as marine protection areas outside of the normal regulatory regimes. Daniela Diz and others, 'Mainstreaming marine biodiversity into the SDGs: The role of other effective T area-based conservation measures (SDG 14.5)' (2018) 93 Marine Policy 251; Siân E Rees, 'Defining the qualitative elements of Aichi Biodiversity Target 11 with regard to the marine and coastal environment in order to strengthen global efforts for marine biodiversity conservation outlined in the United Nations Sustainable Development Goal 14' (2018) 93 Marine Policy 241

511 Dunn and others (n 501) 143, Nicholas J Bax and others, 'Results of efforts by the Convention on Biological Diversity to describe ecologically or biologically significant marine areas' (2015) Conservation Biology 571, 579-80

Criteria For Identifying Ecologically Or Biologically Significant Marine Areas In Need Of Protection In Open-Ocean Waters And Deep-Sea Habitats': uniqueness or rarity; special importance for life-history stages of species; importance for threatened, endangered or declining species and/or habitats; vulnerability, fragility, sensitivity, or slow recovery; biological productivity; biological diversity and naturalness.[512] In addition, the 2008 COP adopted 'scientific guidance for selecting' areas that would establish a network of MPAs.[513] These criteria have considerable overlap with criteria promulgated by other agencies, since the CBD drew from already existing concepts[514]; such synergies can promote a common language and understanding among personnel and entities involved in marine environmental protection[515]. EBSAs need have only one of the seven criteria to qualify for listing[516] and the designation imports no managerial commitment on the part of the relevant state-party[517]. In spite of the minimal state obligations that accompany EBSA designation, as of the end of 2018 only two hundred seventy-nine maritime areas have received the EBSA designation.[518]

As explained earlier, MPAs have proliferated in the RSP and may be seen as a preferred method of conserving marine ecosystems and biodiversity. In 1994 both LOSC and the CBD entered into force, and over time the two global conventions have given considerable legal support to MPAs by obliging states to establish marine areas to preserve biodiversity and protect marine life.[519] The CBD 2004 COP agreed that

[512] CBD Decision IX/20 (n 507) Annex I
[513] ibid Annex II
[514] Dunn and others (n 501) 142
[515] ibid 144
[516] Bax and others (n 511) 574
[517] Dunn and others (n 501) 143
[518] Diz and others (n 510) 253 Bax and others showed that, of the two hundred nine ESBAs in 2015, one hundred nine EBSAs were located in a single national jurisdiction, twenty-eight were transboundary, thirty-five straddled a national jurisdiction and the ABNJ, and thirty-one were solely within ABNJ. Bax and others (n 511) 575, Table 2
[519] ibid 149

> the goal . . . relating to marine and coastal protected areas should be the establishment and maintenance [of MPAs] that are effectively managed, ecologically based and contribute to a global network of marine and coastal protected areas, building upon national and regional systems . . . .[520]

The 2004 CPD COP also recognized the 'urgent need' for 'cooperation and action to improve conservation and sustainable use' of biodiversity in areas beyond national jurisdiction[521] and called for coordination with LOSC regarding deep seabed genetic resources in ABNJ[522].

To advance conservation of biodiversity, in 2010 the CBD adopted the twenty Aichi Biodiversity Targets[523], which replaced the 2002-2010 targets and set biodiversity goals that will guide the state-parties from 2011 until 2020. Designation of MPAs aligns both with the CBD's goal of establishing EBSAs and with Aichi Biodiversity Target 11. Aichi Target 11 focuses on preservation of ocean biodiversity by recommending that by 2020 ten percent of coastal and marine areas be

> conserved through effectively and equitably managed, ecologically representative and well connected systems of protected areas and other effective area-based conservation measures, and integrated into the wider landscapes and seascapes.[524]

At the moment, two years before the 2020 target of ten percent, seven percent of ocean areas have been designated as MPAs.[525]

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520 CBD (2004) Decision VII/5 (n 385) para 18
521 ibid paras 30-1
522 ibid para 54
523 CBD Conference of the Parties, 'Decision X/2: The Strategic Plan for Biodiversity 2011-2020 and the Aichi Biodiversity Targets' (2010) UN Doc UNEP/CBD/COP/DEC/X/2, para 13 (Aichi Biodiversity Targets)
524 ibid
525 'Explore the World's Marine Protected Areas' (n 388)

At the time that LOSC was negotiated, awareness of the importance of marine biodiversity was still in a nascent stage, and the full scope of the CBD did not extend to the Area, leaving a large portion of the ocean without protection of its marine biodiversity. The UN is currently attempting to fill the gap in treaty coverage by negotiating an additional LOSC implementing agreement to protect marine biodiversity in the areas beyond national jurisdiction.[526] The first session of an intergovernmental conference to consider an international legally binding instrument was held in September 2018, and the negotiating parties agreed on four main issues to be addressed: 'capacity-building and the transfer of marine technology; area-based management tools, including marine protected areas; environmental impact assessments; and marine genetic resources, including questions on the sharing of benefits'.[527] Even though the implementing agreement will apply to the Area where mineral resources are considered to be CHM, equitable distribution of marine genetic resources is being negotiated in terms of benefit-sharing[528], which may toll the final death knell for CHM.

The influence of the CBD appears to be gaining momentum and power as a means of protecting marine biodiversity. Coastal states that are parties to the treaty and that have offshore freshwater reserves in their national jurisdictions will have to be cognizant of their CBD obligations, especially those that have

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[526] 'Report of the Preparatory Committee established by General Assembly resolution 69/292: Development of an international legally binding instrument under the United Nations Convention on the Law of the Sea on the conservation and sustainable use of marine biological diversity of areas beyond national jurisdiction' (10-21 July 2017) (31 July 2017) UN Doc A/AC.287/2017/PC.4/2 (PrepComm Report 4); UNGA Res 72/249 (19 January 2018) The number of parties engaged in the fourth and final preparatory session gives an indication of how complex the negotiations for the implementing agreement will be – one hundred thirty-one UN member states, two non-member states, two UN programmes, funds and offices, nine specialized UN agencies and related organizations, ten intergovernmental organizations and twenty-three non-governmental organizations. ibid para 34

[527] 'Concluding Session to Draft Marine Biodiversity Treaty, Conference President Says Environmental Impact Assessments Will Be Reflected in Instrument' (*United Nations Meetings Coverage and Press Releases,* 17 September 2018) <https://www.un.org/press/en/2018/sea2086.doc.htm> accessed 16 November 2018 Three further sessions are envisaged during 2019 and 2020.

[528] Eve Heafey, 'Access and Benefit Sharing of Marine Genetic Resources from Areas beyond National Jurisdiction: Intellectual Property-Friend, Not Foe' (2014) 14 Chicago Journal of International Law 493, 501, 508 Benefit-sharing is addressed in Chapter 5.2.2.

been implemented in domestic legal regimes, when planning for development of the new resource. Both direct and indirect impacts of development on protected ecosystems, species and genomes will fall under the aegis of treaty obligations.[529]

2.3 Conclusion

Should offshore freshwater resources be developed in the near future, those development activities will be governed by treaties and international customary law that provide for both exploitation and protection of marine resources. Under LOSC, coastal and island states will have exclusive sovereign rights to aquifers and methane hydrates that are located in their territorial seas, EEZ Seabeds and OCS. Therefore, subject to obligations to allow innocent passage and protect the marine environment, those states may develop and utilize offshore freshwater in their zones of exclusivity at a time and in a manner they choose in accordance with their own domestic laws and regulations.

States may exploit and distribute resources within their exclusive jurisdictions as they please. For those offshore freshwater resources that lie in the OCS of a single state, LOSC state-parties are obligated to share the benefits of any extracted resource by making payments or contributions in kind to the ISA in amounts up to seven percent of the value or volume of production. LOSC Article 82(4) directs the ISA to distribute the payments or contributions according to 'equitable sharing criteria'. Freshwater aquifers will not be preserved that far from shore, but methane hydrates will almost certainly be present in the OCS. In the event that technology someday allows for recovery of the freshwater component of methane hydrates, one can wonder whether the equitable sharing criteria could be interpreted differently for the freshwater and hydrocarbon components. Out of respect for its vital nature, perhaps freshwater should be contributed in kind, with the contribution for methane production being in a monetary form. Due to the nature of their formation, freshwater resources are

[529] CBD (n 182) Annex I

not expected to be found in the Area, where all resources are the common heritage of mankind and no claim of sovereignty is recognized.

Given the various seabed maritime zones created by LOSC – the territorial sea, the EEZ Seabed, the OCS and the Area – and the number of coastal states and islands, a myriad of transboundary permutations exists. LOSC gives no guidance regarding shared resources, but states with transboundary freshwater resources will doubtless follow the current pattern of finding bilateral solutions such as unitization and joint development arrangements.

The rules regarding sovereign rights for offshore freshwater determine who may develop the resource, but development will necessarily involve disruption to the marine environment, ranging from noise and sediment plumes to deposits of cuttings and dispersal of toxic fluids. States wishing to explore and extract offshore freshwater resources will be subject to multi-layered legal regimes that mandate efforts to preserve and protect the environment. LOSC, the CBD, regional and bilateral treaties, and domestic regulations all have requirements to preserve and protect the marine environment and marine biodiversity, even in areas where states have exclusive sovereign rights. At a minimum, a state initiating a disruptive seabed development project would be required to produce EIAs, notify neighbors of potentially significant transboundary harm, and make an effort to avoid detrimental impacts to endangered species and threatened biodiversity. These actions require due diligence but do not require a particular result, even though significant harm may occur. Any exploration or exploitation of offshore freshwater will have to respect the restrictions placed on domestic and regional MPAs, which may limit the potential area and/or activities available for development. Although the biological health of the oceans continues to decline[530], these measures form the

[530] 'Facts and figures on marine biodiversity' (*UNESCO* 2017) <http://www.unesco.org/new/en/natural-sciences/ioc-oceans/focus-areas/rio-20-ocean/blueprint-for-the-future-we-want/marine-biodiversity/facts-and-figures-on-marine-biodiversity/> accessed 18 November 2018

best means available to guard against further degradation and even collapse of vital marine ecosystems.

Integrated ocean management, including integrated coastal zone management (ICZM), has been implemented in Europe and may apply with increasing frequency to other coastal areas. This coastal management approach may impact development of those aquifers that are hydraulically connected and span both a seabed area and a landmass. For example, abstraction may be limited on one side or the other, either to conserve freshwater for land-based ecosystems or to prevent seawater intrusion through the seabed aquifer. Free-standing offshore aquifers may also be included in ICZM regulations, which could determine how and where exploration and exploitation activities would take place.

Like the sea itself, the laws of the sea are complex, multifaceted and dynamic, and much of the evolution in governance regimes in the past century has been instigated by the contemporaneous and sometimes conflicting goals of developing offshore hydrocarbons and protecting the marine environment from the effects of development activities. Currently, the ISA and the CBD are producing guidance to guard the seabed from the effects of mineral extraction. It will be interesting to see to what extent governance of offshore freshwater exploration and extraction builds on the legal foundations already in place for marine activities and which new policies and regulations will result.

CHAPTER 3

LEGAL PRINCIPLES GOVERNING LAND-BASED FRESHWATER RESOURCES

INTRODUCTION

The previous chapter discussed the UN Convention on the Law of the Sea (LOSC), regional treaties and the Convention on Biological Diversity and briefly touched on how their provisions and principles might apply to offshore freshwater resources. Although LOSC will be the primary governance regime for offshore freshwater resources, land-based freshwater has its own, separate body of international laws, principles and practices that may also influence governance of offshore freshwater. This chapter will examine the historical progression of state claims of sovereignty over both domestic and transboundary land-based freshwater resources and the limitations on sovereign reach that have evolved with those claims. Nations have accepted limitations on their sovereignty as the opportunities for transboundary disputes have multiplied as a result of growing numbers of nations and increasing utilization of freshwater. Those limitations have crystalized into agreed principles to use shared freshwater equitably and reasonably and not to cause significant harm to a neighbor's rights or interests. These substantive principles, along with procedural principles that are common to the law of the sea such as an obligation to cooperate, to give advance notice of planned measures that might have a significant adverse effect on a neighboring state and to share information and data, have been accepted as governing principles of international water law and have been promoted by scholars, honored by courts and enshrined in treaties, all of which will be discussed herein. After reviewing the genesis and content of international water law principles generally, the chapter will then look at guidance and practices that have arisen with respect to governance of transboundary aquifers, since nations sharing confined units of

transboundary offshore groundwater may look to governing principles for land-based transboundary aquifers for direction.

3.1 Genesis of limitations on sovereignty over freshwater

As a consequence of the Industrial Revolution, navigational uses of land-based freshwater such as rivers and lakes began to be regulated during the nineteenth century.[531] The Industrial Revolution resulted in extensive movements of goods and workers, and ensuring access to waterways was a common priority in support of commerce during a period before rail transportation became prevalent.[532] In 1815, the principal European powers attempted to ensure a post-Napoleonic peace by concluding the Act of the Congress of Vienna, which consolidated other bilateral and multilateral treaties and established political boundaries while also giving signatory nations access to all European rivers for navigational purposes.[533] The 1919 Peace Treaty of Versailles that ended World War I likewise stipulated that major rivers of Europe – Rhine, Moselle, Danube, Elbe, Oder and Niemen -- would be open to navigation, even though rail travel was available by that time.[534] Two years later, the Barcelona Convention (Convention and Statute on the Regime of Navigable Waterways of International Concern) extended the principle of freedom of navigation in international rivers

[531] Salman MA Salman, 'The Helsinki Rules, the UN Watercourses Convention and the Berlin Rules: Perspectives on International Water Law' (2007) 23 International Journal of Water Resources Development 625, 625 (Salman 2007); Stephen C McCaffrey, 'The Evolution of International Law Relating to Transboundary Waters' in Alistair Rieu-Clarke, Andrew Allan and Sarah Hendry (eds), *Routledge Handbook of Water Law and Policy* (Routledge 2017) 205-206

[532] Salman 2007 (n 531) 626

[533] 'The navigation of the rivers, along their whole course, refered [sic] to in the preceding Article, from the point where each of them becomes navigable, to its mouth, shall be entirely free, and shall not, in respect to commerce, be prohibited to any one; it being understood that the regulations established with regard to the police of this navigation, shall be respected; as they will be framed alike for all, and as favourable as possible to the commerce of all nations.' art CIX, The General Treaty of the Final Act of the Congress of Vienna, 9 June 1815. The 1815 Treaty of Vienna also established a joint commission to regulate the navigational uses of rivers, a structure that would later become standard for transboundary waters. 'The Powers whose states are separated or crossed by the same navigable river, engage to regulate, by common consent, all that regards its navigation. For this purpose they will name Commissioners, who shall assemble, at latest, within six months after the termination of the Congress, and who shall adopt as the basis of their proceedings, the principles established by the following Articles.' ibid art CVIII

[534] Treaty of Peace with Germany (adopted 28 June 1919, entered into force 10 January 1920) art 331, 356

by including non-European nations.[535] Hence, prior to World War II (WWII), a growing community of nations viewed rivers as shared resources to be utilized for broad commercial benefit. However, after WWII Europe was divided into eastern and western sections, and the freedom of navigation that had been the right of even non-riparian states came to an end.[536]

3.1.1 Pre-WWII development of the law of non-navigational uses

International law addressing non-navigational uses of land-based freshwater did not become a topic of much analysis until the early part of the twentieth century, and that century saw the development of all of the limitations on absolute sovereignty that are now considered to be accepted principles of international water law – equitable and reasonable use of the water, no significant harm to a neighboring state's rights or interests, a duty to cooperate, prior notice of planned activities that might have a significant adverse effect on a neighboring state, environmental protection and sharing of relevant data regarding the shared water resource.[537] However, the priority given to those legal principles greatly depended on whether the organization espousing and/or implementing them was a scholarly institution, an international organization, a sovereign entity or a judicial body.

The first organization to issue legal guidance on shared freshwater resources was the Institute for International Law (IIL), a scholarly institution founded in Ghent, Belgium in 1873 whose pre-eminent representatives of the global legal community must be invited and then elected to membership.[538] At a session

[535] Convention and Statute on the Regime of Navigable Waterways of International Concern (adopted 20 April 1921, entered into force 31 October 1922) 7 League of Nations Treaty Series 35, art 3
[536] Salman 2007 (n 518) 627
[537] A listing and description of these principles can be found in Salman MA Salman, 'The Future of International Water Law: Regional Approaches to Shared Watercourses?' in Mahnoush H. Arsanjani, Jacob Katz Cogan, Robert D. Sloane and Siegfried Wiessner (eds), *Looking to the Future: Essays on International Law in Honor of W. Michael Reisman* (Martinus Nijhoff 2011) 918.
[538] 'History' (*Institut de Droit International)* <http://justitiaetpace.org/historique.php> accessed 28 January 2018

held in Paris in 1910, the IIL decided to determine 'the rules of international law relating to international rivers from the point of view of the utilization of their energy'.[539] At the time of the IIL Paris session in 1910, water was being used for hydropower in England, the US, Canada, Germany, Australia and China, and the future expansion of that type of energy could be easily imagined.[540] A year later the organization issued the Madrid Declaration, which began with an explanation of the reasons for its adoption:

> Riparian States with a common stream are in a position of permanent physical dependence on each other which precludes the idea of the complete autonomy of each State in the section of the natural watercourse under its sovereignty. International law has dealt with the right of navigation with respect to international rivers but the use of water for the purposes of industry, agriculture, etc. was not foreseen by international law.[541]

After acknowledging limitations on full sovereignty over shared watercourses and admitting that it was blazing new trails in international law, the Madrid Declaration proceeded to outline the restrictions on state actions: no alteration of the point where a stream crosses an international boundary, no pollution of the river and no over-abstraction. The declaration also recommended establishment of joint commissions to manage new or renovated 'establishments' when 'serious consequences might result.'[542] The first attempt at defining international legal standards for non-navigational utilization of shared watercourses therefore aimed to ensure peaceful co-existence by focusing primarily on prevention of harm to the watercourse where that harm would impact other riparians and by encouraging communication and

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[539] Report of the Secretary-General, 'Legal problems relating to the utilization and use of international rivers' (1963) UN Doc A/5409, para 1069 (Report of the Secretary-General 1963).
[540] 'A brief history of hydropower' (*International Hydropower Association*) <https://www.hydropower.org/a-brief-history-of-hydropower> accessed 28 January 2018
[541] IIL, 'Madrid Declaration on International Regulations Regarding the Use of International Watercourses for Purposes other than Navigation' (1911) 24 Annuaire de l'Institute de Droit International 365
[542] ibid art II(7)

cooperation through joint commissions. As recognized by Michael Michael and Salman Salman, the Madrid Declaration, in contrast to the Harmon Doctrine of 1896, strongly supported limited territorial sovereignty through its prohibition against transboundary harm.[543]

The next foray into governance of shared waters came through the League of Nations in the form of a treaty. In 1923 fifteen states on three continents and the Free City of Danzig signed the Convention on Hydraulic Power[544], the first modern multilateral treaty that exclusively addressed non-navigational uses of waterways. Unlike the declaration produced by the scholarly IIL, which sought to avoid significant harm to co-riparians, the clear goal of this convention was to encourage and facilitate energy development. States were obligated to enter into discussions even in the planning stages, to agree an equitable sharing of expenses, and to protect both their citizens and third parties. From these provisions, it seems logical to conclude that sovereigns were to be treated as equals, and the sovereigns themselves would agree the limitations on sovereign action, with concerns for the states, their citizens and third parties being mandatory factors. In this 1923 convention, the balance between energy development and no significant harm seems to have been weighed more heavily toward energy development. Equitable arrangements applied only to financial issues, and not to utilization of the resource.

During the fifteen years after adoption of the Convention on Hydraulic Power, the Permanent Court of International Justice (PCIJ) issued two decisions regarding disputes over water resources, and together the two opinions illustrate changing attitudes toward utilization of shared water. In the 1929

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[543] Michael L Michael, 'Allocation of Waters of International Rivers' (1974) 7 Natural Resources Law 45, 50; Salman 2007 (n 518) 628; Salman MA Salman, 'Entry into force of the UN Watercourses Convention: why should it matter?' (2015) 31 International Journal of Water Resources Development 4, 6 (Salman 2015)

[544] Convention relative to the Development of Hydraulic Power affecting more than One State (9 December 1923) 35 League of Nations Treaty Series 75. Contracting states included Austria, Belgium, The British Empire (with New Zealand), Bulgaria, Chile, Denmark, The Free City of Danzig, France, Greece, Hungary, Italy, Lithuania, Poland, Kingdom of the Serbs, Croats and Slovenes, Siam and Uruguay.

Case Relating to the Territorial Jurisdiction of the International Commission of the River Oder (River Oder Case)[545], the Court considered whether an international commission created under the 1919 Peace Treaty of Versailles would have jurisdiction over the tributaries of the River Oder that flowed only through Poland. In addition to ending World War I, the treaty provided that certain rivers, including the River Oder, would be regarded as international rivers available to multiple nations for purposes of navigation and access to the sea.[546] Poland argued that purely domestic tributaries of the Oder River should not be subjected to the jurisdiction of the International Commission and should instead be considered as domestic watercourses to be used for domestic purposes.[547] After affirming the 'international fluvial law . . . principle of freedom of navigation on so-called international rivers'[548], the court described the 'community of interest' principle for which the opinion is known[549]:

> This community of interest in a navigable river becomes the basis of a common legal right, the essential features of which are the perfect equality of all riparian States in the user [sic] of the whole course of the river and the exclusion of any preferential privilege of any one riparian State in relation to the others.[550]

The court went on to declare that 'this common right extends to the whole navigable course of the river'[551] and, after affirming the 'interest that non-

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[545] *Case Relating to the Territorial Jurisdiction of the International Commission of the River Oder (UK Czech Republic, Denmark, France Germany and Sweden v Poland)* (Merits) 1929 PCIJ Rep Series A No 23, Judgment No 16 (*River Oder Case*)
[546] ibid 24, 25
[547] ibid 6
[548] ibid 26
[549] Béla Vitányi, 'The regime of navigation on international waterways Part II: The territorial scope of the regime of free navigation' (1975) 6 Netherlands Yearbook of International Law 2, 23; Stephen C McCaffrey, 'The International Law Commission Adopts Draft Articles on Transboundary Aquifers (2009) 103 American Journal of International Law 272, 288 (McCaffrey 2009); Michael Bowman, 'Environmental protection and the concept of common concern of mankind' in Malgosia Fitzmaurice, David M Ong and Panos Merkouris (eds), *Research Handbook on International Environmental Law* (Edward Elgar 2010) 498
[550] *River Oder Case* (n 545) 27
[551] ibid 28

riparian States may have in navigation on the waterways in question'[552], it ruled that an international river includes not only tributaries but also 'lateral canals and channels constructed either to duplicate or to improve naturally navigable sections of the specified river systems'.[553] With this ruling, the PCIJ expanded the limitations on sovereignty by declaring a community of interest not only in naturally occurring waterways but also in artificially constructed waterways that contribute to navigability. Although as Michael Michael notes, *River Oder* 'was limited to the interpretation of a specific treaty and disregarded the Barcelona Convention'[554], support of the principle of cooperation is inherent in the Court's ruling.

However, less than a decade later, the PCIJ took a more restrictive view of riparian interests in its 1937 opinion regarding *The Diversion of Water from the Meuse (River Meuse Case)*[555]. The case involved a dispute between the Netherlands and Belgium regarding interpretation of an 1863 treaty addressing a diversion of river waters for agriculture that had affected navigation.[556] The conflict that resulted in litigation arose in the 1930s when both countries took steps to construct canals that would divert additional waters.[557] The court first clarified that its deliberations would only include treaty interpretation and that it would not apply 'general rules of international law as regards rivers'.[558] Although the court did not couch its opinion in terms of sovereignty when ruling against the complaints brought by both states, the opinion nonetheless supported the principle of limited territorial sovereignty:

> As regards such canals, each of the two States is at liberty, in its own territory, to modify them, to enlarge them, to transform them, to fill them in and even to increase the volume of water in them from new sources, provided that the diversion of water at the treaty feeder and the volume

[552] ibid
[553] ibid 31
[554] Michael (n 543) 47
[555] *The Diversion of Water from the Meuse* (Merits) 1937 PCIJ Rep Series A/B No 70
[556] ibid 11-12
[557] ibid 16
[558] ibid

> of water to be discharged therefrom to maintain the normal level and flow in the Zuid-Willemsvaart is not affected.[559]

Contrary to its opinion in the *River Oder Case*, the PCIJ in the *River Meuse Case* did not take the opportunity to explain or expand international water law. Referring only to the 1863 treaty, the court gave each party the right to take whatever measures it wished within its own territory, provided that their shared canal was not adversely affected.[560] In less than a decade, the PCIJ retrenched from supporting a community of interests and a form of shared sovereignty in international rivers to declaring that states were free to exercise their sovereign interests within their own territories unless their actions impacted a shared interest in utilization. As Gabriel Eckstein recognized at the end of the twentieth century, viewing and managing an international river as a community of interests may be the ''most efficient and advantageous' but 'its acceptance within the international community is sparse.'[561] However, Michael Bowman views the community of interests principle as the precursor of environmental protection that was supported by the ICJ in the 1997 *Gabčikovos-Nagymaros* case.[562]

After the Convention on Hydraulic Power and the two PCIJ cases, much of the world became engulfed in a global war whose disruptions would bring significant changes to political, social, economic and legal philosophies and institutions. The *River Meuse Case* was decided in the same year that WWII began, and the aftermath of the war brought a shift from traditional concerns about ensuring equitable access to navigational uses of waterways. After WWII ended in 1945, human population increased, industrial activity escalated, food

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[559] ibid 26 The Zuid-Willemsvaart is a canal connecting Liège, Belgium, with Maestricht, Netherlands. ibid 10

[560] As opposed to subsequent pronouncements on the no harm principle that prohibited only significant harm, the court supported an absolute prohibition against harm by dictating that no negative effects should occur.

[561] Gabriel Eckstein, 'Application of International Water Law to Transboundary Groundwater Resources, and the Slovak-Hungarian Dispute over Gabčikovo-Nagymaros' (1995) 19 Suffolk Transnational Law Review 68, 80-1

[562] Bowman (n 549) 498

production surged and international trade expanded, all of which resulted in greater demand for freshwater. Nations logically needed to ensure availability of and access to adequate quantities of freshwater that was of a sufficient quality. As a consequence, in the 1950s and 1960s both courts and international organizations turned their attention to governing non-navigational uses of water.

3.1.2 Lake Lanoux and international obligations

The 1957 *Lake Lanoux Arbitration*[563] provides a good illustration of the evolution of customary international water law and sovereignty over freshwater resources. The dispute arose over plans by France dating back to 1917 to alter the capacity of Lake Lanoux on the French side of the Pyrenees and reroute its waters through the mountains in order to generate hydroelectricity. For its part, Spain wanted to protect the water supply of its agricultural sector. Under the French plan, waters emanating from the lake would be diverted to rivers feeding into the Atlantic Ocean instead of following their natural flow into rivers feeding into the Mediterranean. The lake provided one-fourth of the water flowing into the Carol River, which passed from France into Spain and served as an important source of irrigation water for Spanish agriculture. After several years of discussions, France offered to construct a tunnel to deliver into the Carol River the same volume of water that it would have had prior to the diversion for hydroelectricity. Spain argued that changing the river basin violated the 1866 bilateral Treaties of Bayonne, even though all of the changes would take place in France and the volume of water reaching Spain would not be affected.

Article 8 of the 1866 treaties contains a clear declaration of state sovereignty over all 'standing and flowing' water within a state's jurisdiction and admits that

[563] *Lake Lanoux Arbitration (France v. Spain)* (1957) 12 RIAA 281, 24 ILR 101 <http://www2.ecolex.org/server2.php/libcat/docs/COU/Full/En/COU-143747E.pdf> accessed 28 January 2018. References to page numbers of the opinion will utilize the online version made available through Ecolex.

jurisdiction over water changes when the water flows over the national boundary.[564] While questions and debates about the jurisdiction and control of upstream states have been active for many years, the treaties also voiced a key principle that remains today as a key pillar of customary international water law – the principle of prior notice of planned measures. Under Article 11, should either state plan 'to construct works or grant new concessions which might change the course or the volume of a watercourse' that is being used by the other state, then prior notice must be given, a courtesy that appears in many modern treaties and was noted in the UNEP Draft Principles that are discussed in Chapter 3.2.2 below. Unlike modern treaties, the 1866 treaties allow for sharing of water that is excess to needs[565], a practice that disappeared as natural resources became more valuable and less available.

Although the arbitral panel ruled against Spain, its opinion supported the Spanish demand that a neighboring state's interests must be taken into account when any measures are planned that could have cross-border effects. The tribunal began its reasoning with an explanation of sovereign power: 'Territorial sovereignty plays the part of a presumption. It must bend before all international obligations, but only before such obligations.'[566] According to this reasoning, France would be free to make any diversions or changes within its own territory unless those actions were prohibited by international law. The tribunal then described the limitations on sovereignty imposed by international law that require cooperation:

> there does exist a duty of consultation and of bringing into harmony the respective actions of the two States when general interests are involved concerning waters.[567]

The tribunal went on to explain what those general interests might be:

[564] ibid 2
[565] ibid
[566] ibid 16
[567] ibid 28

> It must first be determined what are the 'interests' which have to be safeguarded . . . . Account must be taken of all interests, of whatsoever nature, which are liable to be affected by the works undertaken, even if they do not correspond to a right. . . . The second question is to determine the method by which these interests can be safeguarded. If that method necessarily involves communications, it cannot be confined to purely formal requirements, such as taking note of complaints, protests or representations made by the downstream state. The Tribunal is of the opinion that, according to the rules of good faith, the upstream State is under the obligation to take into consideration the various interests involved, to seek to give them every satisfaction compatible with the pursuit of its own interests, and to show that in this regard it is genuinely concerned to reconcile the interests of the other riparian State with its own.[568]

By the time the *Lake Lanoux* decision was published in 1957, the Harmon Doctrine had been discredited, the disassembly of colonial regimes was in full swing, and discussions regarding sovereignty were beginning to recognize the value of natural resources but also the limitations of assertions of jurisdiction and power, limitations that were described and supported in the arbitral opinion.

The *Lake Lanoux* arbitral award has come to represent some key principles of international customary water law that, in the words of the panel, act as 'international obligations'. According to Laurence Boisson de Chazournes, *Lake Lanoux* imposed two international obligations on states – prior notice of planned measures and consideration of the interests of concerned states.[569] In addition, the panel called for active consultations between the states that rise

[568] ibid 32
[569] Laurence Boisson de Chazournes, *Fresh Water in International Law* (Oxford University Press 2013) 122

above simple exchanges of views. The panel did not define what the state 'interests' might be, but simply stated that 'all interests, of whatever nature,' need to be considered. Owen McIntyre sees in the obligations imposed by the Court a foreshadowing of '[t]he existence of a general customary obligation on States to cooperate in respect to the development and utilisation of international watercourses.'[570] Through the next few decades, 'all interests' would be defined more narrowly, but the limitations on sovereignty and sovereign actions would remain and would broaden both in number and in scope. In fact, Michael Michael views the *Lake Lanoux* decision as the 'foremost' case among many international and domestic cases supporting limited sovereignty.[571]

3.1.3 The IIL Salzburg Declaration and the ILA Helsinki Rules

In 1961, fifty years after the Madrid Declaration, the IIL issued a second set of guidelines, called the Salzburg Declaration[572], which conveyed a message reflecting the post-WWII priority of utilizing natural resources to support economic interests. In provisions not unlike those found in the Convention on Hydraulic Power, the Salzburg Declaration begins with introductory acknowledgements of the 'economic importance' of water and the 'common interest' in 'maximum utilization' and declares that 'the obligation not to cause unlawful harm to others is one of the basic general principles governing neighbourly relations'.[573] In contrast to the 1911 Madrid Declaration and in spite of the contemporaneous discussions in the UN regarding Permanent Sovereignty over Natural Resources, the Salzburg Declaration does not mention any form of the word 'sovereign'. Instead, Article 2 of the Salzburg Declaration assures each state that it has 'the right to utilize waters which traverse or border its territory' subject to international law and 'the right of utilization of

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[570] Owen McIntyre, 'The Role of Customary Rules and Principles of International Environmental Law in the Protection of Shared International Freshwater Resources' (2006) 46 Natural Resources Journal 157, 179

[571] Michael (n 543) 53

[572] IIL, 'Utilization on Non-Maritime International Waters (Except for Navigation)' (1961) 49(II) *Yearbook of the IIL* 371 (Salzburg Declaration)

[573] ibid first introductory clause

other States interested in the same watercourse or hydrographic basin'.[574] Subsequent articles of the declaration forbid utilization that would 'seriously affect the possibility of utilization of the same waters by other States' without prior notice to the affected state, and they also require assurance of continued 'enjoyment' and 'adequate compensation for any loss or damage.'[575] Settlement of disputes should be on the basis of equity,[576] and activities that are the subject of a dispute should cease until a settlement is agreed.[577] The ninth and final article recommends that states sharing a basin form 'common organs . . . to facilitate their economic development as well as to prevent and settle disputes which might arise'.[578]

By the early 1960s, the concept of not doing significant harm to a neighboring state's resources had been subordinated to equitable utilization of the resource in support of economic development, and the *Trail Smelter* solution of imposing an obligation of compensation for loss or damage had been adopted.[579] The principles of prior notice and cessation of disputed activities had gained acceptance, and the Salzburg Declaration supported establishment of a joint commission. The IIL did not issue any further notable water-related declarations, but all of the concepts mentioned above would come to be accepted as customary international water law.

Remarkably, another organization dedicated to international law was also formed in Belgium in the same year as the IIL, but the International Law Association was founded in Brussels instead of Ghent, and its membership is

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[574] ibid art 2
[575] ibid arts 4, 5
[576] ibid art 3
[577] ibid art 7
[578] ibid art 9 References in earlier drafts to settlement of disputes in accordance with the UN Charter and through the International Court of Justice were not retained in the final declaration. See Report of the Secretary-General 1963 (n 539) para 1074
[579] For a discussion of the impact of the *Trail Smelter* arbitration, see James R Allum, '"An Outcrop of Hell": History, Environment, and the Politics of the Trail Smelter Dispute' in Rebecca M Bratspies & Russell A Miller (eds) *Transboundary Harm in International Law: Lessons from the Trail Smelter Arbitration* (Cambridge University Press 2006) 14-18.

open to all interested persons.[580] The ILA took up the topic of international watercourses in 1954, prompted by several post-WWII disputes over utilization of rivers: India and Pakistan regarding the Indus River, Egypt and Sudan regarding the Nile River, Israel and neighboring states regarding the Jordan River, and Canada and the US regarding the Columbia River.[581] In an indication of the importance accorded to riparian interests, the ILA Committee on the Uses of the Waters of International Rivers (called the Rivers Committee)[582] began with eight members at its inception in 1954 and by 1966 had thirty-six members and five alternates.[583] Charles Bourne, a Canadian law professor who served from the early 1960s through the 1990s on various ILA committees that focused on freshwater governance, observed that, in the absence of clear international law guidelines, four competing theories of sovereignty arose:

> territorial sovereignty (no restraint on a state's use of waters in its territory); riparian rights (a state is entitled to the flow of the waters undiminished in quantity and unchanged in quality unless it consents otherwise); prior appropriation (existing uses cannot be adversely affected by subsequent uses); and equitable apportionment (each co-basin state is entitled to a reasonable and equitable share of the beneficial uses of the waters)[584]

The first two theories correspond to absolute territorial sovereignty and absolute territorial integrity, both of which were discussed in Chapter 2 and neither of which prevailed in the ILA or in international law. While prior appropriation 'has been the primary institution for the development and use of western [US] water'[585], the theory of equitable apportionment would evolve

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[580] 'About us' (*International Law Association)* <http://www.ila-hq.org/index.php/about-us/aboutus2> accessed 28 January 2018
[581] Charles B Bourne, 'The International Law Association's Contribution to International Water Resources Law' (1996) 36 Natural Resources Journal 155, 156
[582] ibid 156
[583] ibid 157-158
[584] ibid 156
[585] A Dan Tarlock, 'The Future of Prior Appropriation in the New West' (2001) 41 Natural Resources Journal 769, 769

into the principle of equitable and reasonable utilization and eventually become the predominant principle in international water law.

At its 1956 conference in Dubrovnik the ILA adopted a statement of principles regarding use of international rivers, which was dubbed the Dubrovnik Statement.[586] The ILA did not follow the IIL in using the term 'watercourse or hydrographic basin', a broad concept that encompassed an entire river basin. The ILA preferred instead the more limited term 'international river' and defined it as one that passes through or between two or more states. Charles Bourne recalled that the members engaged in a debate over the balance between the principles of no significant harm and equitable apportionment, and an attempt was made to accommodate both, although there was support for the proposition that 'the no harm rule ultimately had to yield first place in international water law to equitable apportionment'.[587] The Dubrovnik Statement confirmed that 'each State has sovereign control over the international rivers within its own boundaries' but limited that sovereign control by making it subject to 'due consideration for its effects upon other riparian States'.[588] Principle IV of the Dubrovnik Statement supported the no significant harm principle by making a state legally responsible for transboundary injury resulting from activities in its jurisdiction, and Principle V advised states to balance benefits and injuries when discussing agreements or disputes, with a list of five factors to consider:

> (a) The right of each to a reasonable use of the water;
> (b) The extent of the dependence of each State upon the waters of that river;
> (c) The comparative social and economic gains accruing to each and to the entire river community;
> (d) Pre-existent agreements among the States concerned;

[586] International Law Association, 'Report Of The Forty-Seventh Conference' (Dubrovnik 1956) 244-48 (Dubrovnik Statement)
[587] Bourne (n 581) 160
[588] Dubrovnik Statement (n 586) principle III

(e) Pre-existent appropriation of water by one State[589]

The Dubrovnik Statement set a new standard by introducing factors that should be considered when balancing riparian interests. Consideration of the effect of various factors on multiple parties sharing the same resource suggests an analysis based on a community of interests and not on powerful sovereign interests. The Dubrovnik Statement supported additional limitations on sovereignty over freshwater resources that were similar to the IIL's declarations, such as an obligation to give prior notice of planned measures and legal responsibility for transboundary pollution. The final principle adopted in Dubrovnik advised riparian states to 'join with each other to make full utilization of the waters of a river . . . so as to assure the greatest benefit to all'.[590] The Dubrovnik Statement therefore ends with a principle that reflects a community of interests, cooperation among states and maximum utilization of the resource.

The ILA continued to turn its attention to shared freshwater resources and at a 1958 conference in New York unanimously adopted a report that returned to the drainage basin concept, defining drainage basins in terms that presaged the UN Watercourses Convention definition of watercourse[591]:

> [A] drainage basin is an area within the territories of two or more States in which all the streams of flowing surface water, both natural and artificial, drain a common watershed terminating in a common outlet or common outlets either to the sea or to a lake or to some inland place from which there is no apparent outlet to a sea.[592]

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[589] ibid principle V
[590] ibid principle VIII
[591] Article 2(a) of the UN Watercourses Convention defines a watercourse as 'a system of surface waters and groundwaters constituting by virtue of their physical relationship a unitary whole and normally flowing into a common terminus.' Convention on the Law of the Non-navigational Uses of International Watercourses (adopted 21 May 1997, entered into force 17 August 2014) 36 ILM 700 (UN Watercourses Convention)
[592] Report of the Secretary-General 1963 (n 539) para 1082

In New York the ILA agreed to four principles of international law, the first of which stated that rivers and lakes in a drainage basin should be treated as 'an integrated whole' that might necessarily include 'underground waters'. The other principles included the right of each co-riparian to 'a reasonable and equitable share in the beneficial uses of the waters of the drainage basin', 'a duty to respect the legal rights of each co-riparian State' and a duty to ensure that other parties under a state's control also respect the legal rights of a co-riparian.[593] Determination of reasonable and equitable shares was to be decided on a case-by-case basis depending on the particular facts and circumstances. The principles of international law that were agreed in New York did not include any mention of sovereign rights nor did they include other tenets of customary law such as a clear prohibition against doing significant harm to another state's freshwater resources and prior notice of planned measures. The equitable utilization principle prevailed once again, and this time a state's existing uses of waters were not protected against another state's future needs for those same waters. [594]

These efforts and others by the ILA and its Rivers Committee laid the foundation for a set of guidelines that became the cornerstone of future agreements on shared freshwater resources – the 1966 Helsinki Rules on the Uses of the Waters of International Rivers (Helsinki Rules).[595] The Helsinki Rules retained the concept of a drainage basin management system and included both surface and groundwaters flowing into a common terminus[596], consequently excluding non-recharging aquifers such as offshore aquifers that do not flow into a common terminus with related surface waters. To quote Charles Bourne, the

[593] ibid. Reports and extensive guidelines on the settlement of disputes over freshwater resources that were produced by the ILA Committee on the Uses of the Waters of International Rivers were addressed at the 1960 ILA meeting in Hamburg, Germany and the 1962 meeting in Brussels, Belgium. ibid paras 1084 and 1088, respectively.
[594] Bourne (n 581) 164
[595] ILA, 'Helsinki Rules on the Uses of Waters of International Rivers', International Law Association Report of the Fifty-second Conference (Helsinki 1966) (International Law Association, London 1967) (Helsinki Rules)
[596] ibid, art II. Professor Bourne believed that the 'unity of an international drainage basin . . . . was and till is a doubtful proposition of law.' Bourne (n 581) 176

Helsinki Rules 'make it abundantly clear that, for the ILA, the principle of equitable utilization of the waters of an international drainage basin is the dominant theory of law'.[597] An expanded description of the principle of equitable and reasonable use occupied five articles and one of the six chapters in the Helsinki Rules[598], and the list of factors to be considered when determining equitable and reasonable uses grew from the five provided in the Dubrovnik Statement to eleven.[599] This time current uses were not to be denied to a state in order to preserve water for future needs of another state. In the opinion of Michael Michael, this failure to protect future water needs discriminated against developing nations in favor of developed countries whose utilization of water had already matured.[600]

Although the guidelines provided in the Helsinki Rules may be viewed as limitations on sovereignty, the words sovereign and sovereignty do not appear. The principle of no significant harm to a neighbor's resources is represented indirectly in two places only: as one of the factors to be considered in determining equitable use[601] and by a prohibition against 'any new form of water pollution or any increase in the degree of existing water pollution in an international drainage basin which would cause substantial injury in the territory of a co-basin State'.[602] States were also advised to reduce existing forms of pollution in order not to cause 'significant damage' to co-riparians.[603] Under the terms of the rules, violations of the pollution provisions should result in a cessation of the offending activity and compensation to the injured party.[604] After issuing the Helsinki Rules, the ILA continued its work on freshwater and established the Committee on International Water Resources Law, which constituted six working groups, one of which devoted its attentions to

[597] ibid 166
[598] Other chapters of the Helsinki Rules addressed pollution, navigation, timber floating and dispute settlement.
[599] Helsinki Rules (n 595) art V
[600] Michael (n 543) 65
[601] Helsinki Rules (n 595) art V(2)(k)
[602] ibid art X(1)(a)
[603] ibid art X(1)(b)
[604] ibid art XI(1)

groundwater.[605] The Working Group on Underground Waters acknowledged that there were 'few, if any international law rules dealing specifically with the subject of underground waters'[606], and in 1986, nearly twenty years after establishment of the working group in 1968, the ILA issued the Seoul Rules on International Groundwaters[607], which will be discussed in Chapter 3.4.1.

The Helsinki Rules and their limitations on sovereignty over freshwater resources have had a significant impact on international water law, as, in an era of rapid economic development, states and scholars readily accepted equitable and reasonable use as a standard. By 1982 Robert Hayton acknowledged that the principle of 'equitable utilization' had 'become widely accepted, if not fully comprehended'.[608] Salman Salman stated that this wide acceptance of the Helsinki Rules helped enshrine the principle of 'reasonable and equitable utilization' as 'the basic principle of international water law' with respect to shared river basins.[609] In fact, in his opinion, the Helsinki Rules 'are the first general codification of the law of international watercourses', and, until adoption of the UN Watercourses Convention in 1994, they 'remained the single most authoritative and widely quoted set of rules for regulating the use and protection of international watercourses'.[610] The philosophy of a community of interests that opened the twentieth century faded as navigational uses of watercourses became less of a priority than non-navigational uses, but states still agreed that cooperation and limitations on sovereignty should prevail in the presence of shared watercourses.

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[605] Supplementary Report of the Secretary-General, 'Legal problems relating to the non-navigational uses of international watercourses (1974) UN Doc A/CN.4/274, (Supplementary Report of the Secretary-General 1974), para 407
[606] ibid para 408
[607] Committee on International Water Resources Law, 'Seoul Rules on International Groundwater', International Law Association Report of the Sixty-Second Conference (Seoul 1986) (International Law Association, London 1987) (Seoul Rules)
[608] Robert D. Hayton, 'The Law of International Aquifers' (1982) 22 Natural Resources Journal 71, 74
[609] Salman 2007 (n 531) 629
[610] ibid 630

Thus, prior to UN guidance on non-navigational uses of shared freshwater resources, states, courts and legal scholars had already advanced several limitations on sovereignty. Scholarly organizations began with an emphasis on preventing transboundary harm and then migrated to an emphasis on reasonable and equitable utilization. Judicial decisions supported additional limitations on sovereignty, such as consultation, notification and cooperation. These limitations would be retained and expanded in the ensuing years.

3.2 Early UN efforts

During the 1950s through the 1980s, at least five groups affiliated with the UN put non-navigational uses of shared watercourses on their agendas.

3.2.1 The 1977 UN Water Conference in Mar del Plata

The ILA explained its continuing interest in freshwater governance by observing that, in spite of frequent suggestions to study the law of international rivers, the UN International Law Commission (UNILC), 'because of its many other important tasks, [had not] been able to give this matter the priority needed'.[611] A review of the activities of the UN regarding freshwater lends support to the ILA's observation, for the first UNGA resolution requesting a study on the law of freshwater resources was adopted in 1959, but the UNILC did not put the matter on its long-term agenda until 1974.[612] The reasons for the UNGA's concerns were evident. While the days of viewing navigable rivers as an open resource were drawing to a close, other uses of freshwater were mounting as the post-WWII economic expansion and the concurrent population boom demanded more water for industrial, agricultural and domestic purposes[613],

[611] International Law Association, Report of the Fifty-third Conference (Buenos Aires 1968) (International Law Association, London, 1969) 521, as cited in Supplementary Report of the Secretary-General 1974 (n 605) para 406
[612] ILC, 'Consideration of recommendation concerning commencement of the work on the law of non-navigational uses of international watercourses' (22 July 1974) UN Doc A/CN.4/283
[613] Yoshihide Wada and others, 'Human water consumption intensifies hydrological drought worldwide' (2013) 8 Environmental Research Letters 1, 6. According to the authors, between

resulting in lower stream flow volumes worldwide.[614] In the 1950s, two transboundary river basins – the Nile and the Indus -- experienced conflict over water, and a desire to resolve that conflict as peacefully as possible prompted intervention from international organizations.[615]

Sensing that water could be an ongoing source of disharmony among nations, the UNGA passed a Resolution 1401 (XIV) in 1959 requesting that the UN Secretary-General undertake '[p]reliminary studies on the legal problems relating to the utilization and use of international rivers.[616] The report, issued in 1963[617], gave a detailed listing of domestic laws, bilateral and multilateral treaties, judicial decisions and guidance from non-governmental organizations concerning non-navigational uses of international rivers. Beginning in 1970, the UNGA passed three more resolutions requesting that the UNILC begin the work of codifying international law relating to watercourses,[618] and the UNGA also commissioned an update of the 1963 report for the benefit of the UNILC. That supplementary report was issued in 1974[619], but neither the 1963 report nor the 1974 report included groundwater in its scope.

The UN Economic and Social Council was also interested in freshwater, and in May 1973 it adopted a resolution to hold a water conference in 1977.[620] A total of one hundred sixteen states, eighteen UN offices, bodies and agencies, sixteen intergovernmental agencies and sixty-three non-governmental organizations attended the United Nations Water Conference (UN Water Conference), which

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1960 and 2010 human consumption of water increased by two and a half times, with the agricultural sector commanding the bulk of the water. ibid

[614] ibid 1

[615] Salman 2015 (n 543) 2

[616] UNGA Res 1401 (XIV) (21 November 1959). UNGA Resolution 1401 was adopted one year after the UNGA adopted Resolution 1314 (XIII) establishing a committee to conduct a survey on sovereignty over natural resources. UNGA Res 1314 (XIII) (12 December 1958)

[617] Report of the Secretary-General 1963 (n 539)

[618] UNGA Res 2669 (XXV) (8 December 1970)

[619] Supplementary Report of the Secretary-General 1974 (n 605)

[620] 'Report of the United Nations Water Conference' (Mar del Plata 14-25 March 1977) UN Doc E/Conf.70/29 (Mar del Plata Report), para 2

was held in March 1977 in Mar del Plata, Argentina.[621] The UN Water Conference marked the first time that a global forum had been held to address the world's water issues.[622] The purpose of the conference was made clear in a statement sent to the attendees by the UN Secretary-General explaining that '[a]n adequate supply of water was essential to every aspect of the socio-economic development to which the United Nations was committed'.[623] Further, '[i]t was both hoped and expected that the UN Water Conference would make its own specific contribution towards a new international economic order'.[624] The final report of the conference featured the Mar del Plata Action Plan that presented seventy-five pages of recommendations and resolutions.[625] In addition to urging the UNILC to give 'higher priority' to the law of international watercourses[626], the action plan recommended greater cooperation among nations in a variety of areas: water resource assessment; water use efficiency; environment, health and pollution control; policy, planning and management; natural hazards; public information, education, training and research, and regional and international cooperation.[627] Cooperation on water resources was such a prevailing theme of the first global water conference that protection of sovereign interests did not appear in the final report. Indeed, principles such as equitable utilization and no significant harm were not mentioned either, since the principal intent of the conference was to ensure adequate water resources for economic and social development.

When starting work on international watercourses during its 1972 session, the UNILC expressed some skepticism about the value of its efforts, saying that drafting legal guidance on non-navigational uses of international watercourses would necessarily 'be at such a level of generality as to be of extremely limited

[621] ibid 94-95, paras 17-23
[622] ibid 102, para 46
[623] ibid 95, para 24
[624] ibid 102, para 55
[625] ibid 7-81
[626] ibid 53, para 93(a)
[627] ibid iii

utility' due to 'the variations in river basins'.[628] Nevertheless, the process continued, and by the time the newly-formed UNILC Sub-Committee on the Law of the Non-Navigational Uses of International Watercourses delivered its first report in 1974[629], the five committee members, led by Richard Kearney, had the benefit of the 1963 and 1974 reports on Legal Problems Relating to the Utilization and Uses of International Rivers that had been prepared by the Secretary-General. From these reports and their own deliberations, the sub-committee recognized that shared watercourses could lead to 'international competition' and that the role of the legal community was 'to form the legal principles . . .to regulate this competition'.[630] Water use was deemed to have two main limitations: water quantity due to multiple uses and water quality due to pollution.[631] Protection of sovereign interests related to water quantity were couched in terms of distributive justice between neighboring states[632], and protection of sovereign interests related to water quality revolved around liability for illegitimate waste disposal that affected a neighbor[633]. Although the sub-committee referenced the prior work of the IIL[634] and ILA[635], those references were solely for purposes of seeking a definition of international watercourses, and no legal principles such as equitable apportionment or no significant harm were mentioned in the sub-committee's first report produced under Special Rapporteur Richard Kearney. In 1977 Stephen Schwebel replaced Richard Kearney as Special Rapporteur for the UNILC's study of non-navigational uses of watercourses.[636] As will be discussed in Chapter 3.2.3, Schwebel had a keen interest in treating international watercourses as shared natural resources, an approach to communal governance being explored at the

[628] ILC, 'Review of the Commission's Long-Term Programme of Work: "Survey of International Law" Prepared By The Secretary-General' (1972) UN Doc A/CN.4/245, para 35
[629] ILC, 'Report of the Sub-Committee on the Law of the Non-Navigational Uses of International Watercourses' (1974) UN Doc A/CN.4/283
[630] ibid para 29
[631] ibid para 32
[632] ibid
[633] ibid para 33
[634] ibid para 14
[635] ibid para 15
[636] ILC, 'Report of the International Law Commission on the work of its twenty-ninth session 9 May-29 July 1977' (1977) UN Doc A/32/10, para 79

time through various UN initiatives that would have expanded the limitations on absolute sovereignty.

3.2.2 Shared natural resources and the UNEP Draft Principles

At the 1977 UN Water Conference, states highlighted the importance of cooperation in shared water resources[637] such as river basins, lake basins and aquifers, stressing that 'equitable sharing and optimum utilization' would be best achieved through negotiation.[638] Birnie, Boyle and Redgwell describe shared natural resources as 'a limited form of community interest'[639], where nations are forced to cooperate if they want to maximize the return on development. Due to geological formations and fluid dynamics, issues surrounding ownership can be especially complex and contentious when the shared natural resource is sequestered underground in liquid form, such as oil, gas and water. Yet, in spite of the need for conflict prevention and resolution, international law provides very little guidance on shared natural resources.[640]

There are probably many reasons for the lack of legal guidance regarding neglect of transboundary resources. Until rising global populations led to greater demand for ever-dwindling natural resources, access to domestic reserves and commercial availability of additional resources through trade provided for most needs. Further, the old colonial regimes allowed hegemonic powers to siphon the natural resources of their colonies, so resort to international law was unnecessary since the colonial powers had ownership

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[637] Mar del Plata Report (n 620) p 51-52, paras 84-89

[638] ibid 114, para 113. In a foreshadowing of future debates, the report cautioned in a footnote that use of the term shared water resources 'did not prejudice the position of countries supporting the terms "transboundary waters" or "international waters"'. ibid 114, n 9

[639] Patricia Birnie, Alan Boyle & Catherine Redgwell, *International Law & the Environment* (3rd edn 2009) 192

[640] Ian Brownlie, *Principles of Public International Law* (7th edn, Oxford University Press 2008) 274; Alberto Szekely, 'The International Law of Submarine Transboundary Hydrocarbon Resources: Legal Limits to Behavior and Experiences for the Gulf of Mexico' (1986) 26 Natural Resources Journal 733, 738, 743; John Baloro, 'Some International Legal Problems Arising From The Definition And Application Of The Concept Of "Permanent Sovereignty Over Wealth And Natural Resources" Of States' (1987) 20 Comparative & International Law Journal of South Africa 335, 343; Chris Armstrong, 'Against 'permanent sovereignty' over natural resources' (2015) 14 Politics, Philosophy & Economics 129, 144

rights over the natural resources in their respective colonies. With the growing number of independent nations and their newly-declared national boundaries, opportunities for natural resources to be classified as transboundary assets multiplied; what was formerly a solely domestic resource could become a transboundary shared resource with the stroke of a pen. In addition, technology has allowed increased exploration and development of more natural resources, leading to discovery of reserves that have until now escaped detection and exploitation. Finally, the value of natural resources such as hydrocarbons has exploded in recent decades, producing more frequent discussions among neighbors about how to apportion the transboundary natural wealth embedded in hydrocarbon reserves. At the same time, nations may have grown more reticent about forging iron-clad rules on sovereignty, ownership and utilization that would restrict their flexibility.

To fill the vacuum, the UN initiated an analysis of shared natural resources in 1973, the year after the Stockholm Declaration and the year before New International Economic Order (NIEO) and the Charter of Economic Rights and Duties of States (CERDS) were launched.[641] In UN Resolution 3129 (XXVIII)[642], the UNGA reaffirmed Principles 21, 22 and 24 of the Stockholm Declaration[643], noted its prior resolutions regarding state responsibility for environmental protection, and requested the UN Environment Programme (UNEP) to produce a report on 'international standards for the conservation and harmonious exploitation of natural resources common to two or more States' based on 'a

[641] NIEO was enacted by UNGA Res 3201 (S-VI) (1 May 1974) and UNGA Res 3202 (S-VI) (1 May 1974). NIEO was subsequently supported by a number of UNGA resolutions: UNGA Res 63/224 (19 December 2008); UNGA Res 64/209 (21 December 2009); UNGA Res 65/167 (20 December 2010); UNGA Res 67/217 (21 December 2012); UNGA Res 69/227 (19 December 2014), and UNGA Res 71/236 (21 December 2016). CERDS was enacted later the same year through UNGA Res 3281 (XXIX (12 December 1974)

[642] UNGA Res 3129 (XVIII) (13 December 1973)

[643] Principle 21 of the Stockholm Declaration acknowledges the sovereign right of states to exploit their natural resources, Principle 22 encourages states to cooperate in developing international law to address compensation for transboundary environmental damage, and Principle 24 urges bilateral and multilateral cooperation 'to effectively control, prevent, reduce and eliminate adverse environmental effects'. 'Declaration of the United Nations Conference on the Human Environment', United Nations Conference on the Human Environment (Stockholm, 5-16 June 1972) UN Doc A/CONF.48/14/REV.1

system of information and prior consultation'.[644] Four years later, in 1978, the UNEP Governing Council produced the 'Draft Principles of Conduct in the Field of the Environment for the Guidance of States in the Conservation and Harmonious Utilization of Natural Resources Shared by Two or More States' (UNEP Draft Principles)[645]. These fifteen principles highlighted equitable utilization and cooperation 'with a view to controlling, preventing, reducing or eliminating adverse environmental effects' from utilization of natural resources[646] and encouraged states to enter into bilateral and multilateral agreements.[647] '[T]he sovereign right to exploit their own resources'[648] and the priority status of economic development[649] were reaffirmed, and the UNEP Draft Principles encouraged environmental assessments[650] and exchanges of information[651]. The UNEP Draft Principles also proclaimed that 'it is necessary' for states to give prior notice of planned measures that 'can reasonably be expected to affect significantly the environment' of another state.[652] In addition, the text of the draft principles highlighted liability under international law for transboundary environmental damage[653] and urged states 'to take into account the potential adverse environmental effects arising out of the utilizations of shared natural resources' even in domestic activities[654].

According to Nico Schrijver, the Draft UNEP Principles led to disputes over sovereignty. Some states were concerned that the draft principles encroached on their sovereignty, while France and Germany objected to support of the concept of Permanent Sovereignty over Natural Resources in the preamble,

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[644] UNGA Res 3129 (XVIII) (n 634)
[645] UN Environment Programme, 'Draft Principles of Conduct in the Field of the Environment for the Guidance of States in the Conservation and Harmonious Utilization of Natural Resources Shared by Two or More States' (United Nations 1978)
[646] ibid prin 1
[647] ibid prin 2
[648] ibid prin 3.1
[649] ibid prin 15
[650] ibid prin 4
[651] ibid prin 5
[652] ibid prin 6.
[653] ibid prin 12.1
[654] ibid prin 13

arguing that no state had full authority over its natural resources.[655] Ultimately, the UNGA passed Resolution 186 (XXXIV), simply taking note of the principles and encouraging states to use them as guidelines in bilateral and multilateral conventions regarding shared natural resources.[656] Although the 1978 UNEP Draft Principles support some of the core principles of the growing body of customary international law addressing transboundary resources, such as equitable utilization, avoidance of environmental harm, cooperation and prior notice of planned measures, the full practical value of UNEP's proposed principles of sharing natural resources has yet to be demonstrated as they have languished in diplomatic oblivion.

UNEP was not alone in promoting the philosophy of shared natural resources. In 1982 another UN-related organization issued a declaration regarding water as a shared natural resource. The UN Economic Commission for Europe (UNECE) adopted the 'ECE Decision on International Cooperation on Shared Water Resources'.[657] The first pre-ambular paragraph explained the impetus for the decision by noting the significance of transboundary streams, lakes and 'related ground water aquifers' in the 'interrelationships between ECE countries'. In harmony with contemporary philosophy about natural resources, the second pre-ambular paragraph reaffirmed the principle of permanent sovereignty over natural resources. The main purpose of the Decision was to encourage UNECE members to collaborate in 'the development, use and conservation of shared water resources'[658], and cooperation through agreements[659], arrangements[660] and international river commissions[661] was strongly advocated. As will be described later in this chapter, the UNECE continued its efforts to provide guidance on shared water resources, including

[655] Nico Schrijver, *Sovereignty Over Natural Resources* (Cambridge University Press 1997) 132-133
[656] UNGA Res 186 (XXXIV) (18 December 1979)
[657] UN Economic Commission for Europe (UNECE), 'ECE Decision on International Cooperation on Shared Water Resources' (1982) Decision D (XXXVII)
[658] ibid para 1
[659] ibid para 2
[660] ibid para 3
[661] ibid para 4

groundwater, by producing guidelines and agreements that in many ways were more supportive of a common approach than the guidance produced by the UNILC.

3.2.3 UNILC – from shared natural resources to protection of sovereignty

During his tenure as Special Rapporteur of the UNILC's efforts to codify the law of non-navigational uses of international watercourses, Stephen Schwebel was a strong advocate in favor of viewing international watercourses as shared natural resources. To him, '[i]f the concept of natural resources shared by two or more States has any core of meaning, it must be derived from the water of international watercourses'.[662] Indeed, in his second report to the UNILC he introduced a draft Article 7 for the forthcoming convention entitled "A shared natural resource', which provided that states 'shall treat the water of an international watercourse system as a shared natural resource'[663]. While admitting that the 'articulation' of the term was 'relatively new and incomplete' and that the concept was not a principle of international law, he argued that sharing of natural resources had already given rise to an obligation to cooperate on utilization of the resource.[664] His report cited CERDS[665], the 1977 Water Conference[666] and the UNEP Draft Principles[667] as supporting the philosophy of shared natural resources and cooperation in their utilization.

Stephen Schwebel's second report referenced the Truman Proclamation and the International Court of Justices (ICJ)'s *North Sea Continental Shelf* cases as precedent for treating international watercourses as systems and for encouraging states to enter into good faith negotiations regarding each of those

[662] ILC, 'Second report on the law of the non-navigational uses of international watercourses, by Mr. Stephen M. Schwebel, Special Rapporteur' (1980) UN Doc A/CN.4/332 and Add l (Schwebel 1980 Report) para 141
[663] ibid para 142
[664] ibid para 143
[665] ibid paras 144-148
[666] ibid paras 149-152
[667] ibid paras 156-185

systems.[668] Presumably, co-riparians that take a holistic approach to watercourses and engage in cross-border communication would achieve results that the parties would consider to be equitable and reasonable. In his estimation, the 'unity of deposits of natural resources of the continental shelf, while a substantial factor, is dwarfed by the unity of water in a watercourse'[669], and thus, logically,

> if there is an obligation of international law to negotiate continental shelf boundaries taking the unity of resource deposits into account, there is equally an obligation under international law to negotiate with respect to the apportionment of the use of water.[670]

The report referred to the *Lac Lanoux* arbitration case as evidence of 'the obligation of States to negotiate the apportionment of the waters of an international watercourse'[671] and also favorably cited similar provisions in the UNEP Draft Principles[672]. In scholarly fashion, Stephen Schwebel extended his advocacy for a community of interests in international watercourses by referring to law that developed with respect to navigation, such as the *River Oder Case*[673], a French decree of 1792[674], the Barcelona Convention on Navigable Waterways[675], bilateral and multilateral treaties from Latin America, Asia, Africa and Europe[676], and the Helsinki Rules[677].

Stephen Schwebel's advocacy for treating international watercourses as shared natural resources may have contributed to the philosophy being retained for the

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[668] ibid paras 69-80. Schwebel also cited to the ICJ *Fisheries Jurisdiction* cases as support for a duty to negotiate utilization of a common resource. id paras 81-85. *Fisheries Jurisdiction Case (United Kingdom v. Iceland)* (Merits) (1974) ICJ Rep, 3, para 75 The *North Sea Continental Shelf* cases will be discussed in Chapter 4.
[669] Schwebel 1980 Report (n 622) para 79
[670] ibid para 80
[671] ibid para 88
[672] ibid para 90
[673] ibid paras 187-193
[674] ibid paras 194-197
[675] ibid paras 198-203
[676] ibid paras 204-211
[677] ibid paras 212-214

duration of his tenure as Special Rapporteur. In Schwebel's third and final report, prepared before he resigned from the UNILC in 1981 to take a seat on the ICJ, the idea of shared natural resources appears once again in a separate draft article[678], and additional draft articles were introduced to address principles of equitable participation (akin to equitable utilization), no appreciable harm, information exchange and environmental protection.[679] In addition to producing the draft articles, Schwebel provided extensive rationale in the text of his final report for including equitable participation[680], no appreciable harm[681], information exchange[682] and environmental protection[683] among the principles governing non-navigational uses of international watercourses.

Jens Eversen replaced Stephen Schwebel in 1982,[684] and during his tenure the position of the UNILC on shared natural resources changed considerably. In the early days of the UN's involvement in governance of shared watercourses, the organization through the Mar del Plata Action Plan and the UNEP Draft Principles showed a marked preference for the philosophy of a community of interests in shared natural resources, which translates into greater cooperation among states and increased limitations on sovereignty. However, by the time that the UNILC finally became engaged in governance of non-navigation uses of transboundary watercourses, states had reverted to protection of sovereign interests, and the idea of sharing in the bounty of natural resources no longer enjoyed broad political support. In a sense, Schwebel represented a philosophy that was a product of the 1970s, and through the 1980s and 1990s nations grew much more parochial and territorial in protecting their sovereign interests and

[678] ILC, 'Third report on the law of the non-navigational uses of international watercourses, by Mr. Stephen M. Schwebel, Special Rapporteur' (1982) UN Doc A/CN.4/348, para 27
[679] ibid para 39
[680] ibid paras 41-110
[681] ibid paras 111-186
[682] ibid paras 187-242
[683] ibid paras 243-336
[684] ILC, 'Report of the International Law Commission on the work of its thirty-fourth session (3 May-23 July 1982)' (1982) UN Doc A/37/10, para 250, 251. Schwebel resigned from the UNILC in 1981 after being elected to the ICJ.

their right to access water in support of development. At the same time, the principles underlying international water law had grown more defined, and, as the next section will illustrate, the conflict between sovereign utilization and *sic utere tuo* would become more pronounced and more controversial.

3.3 Sovereign utilization vs. sic utere tuo: The UN Watercourses Convention and the UNECE Water Convention

Two water conventions were adopted in the 1990s, the UN Convention on the Law of the Non-navigational Uses of. International Watercourses (UN Watercourses Convention) and the UNECE Convention on the Protection and Use of Transboundary Watercourses and International Lakes (the UNECE Water Convention), and both would ultimately be open to all UN members.[685] Although each of them embodies the general principles of customary international water law, the two conventions represent different balances between the two principles of equitable utilization and *sic utere tuo*.

3.3.1 The UN Watercourses Convention and the supremacy of sovereign utilization over *sic utere tuo*

In his second report to the UNILC in 1984, Special Rapporteur Jens Eversen began by explaining that in order to be effective a convention on the law of non-navigational uses of watercourses had to represent the proper balance 'between the inter-dependence of riparian States and their sovereignty, independence and right to benefit from the natural resources within their borders'.[686] He acknowledged that the philosophy of shared natural resources was now subject to 'considerable doubt and opposition' and that he himself had been criticized for not 'expressing the basic principle of sovereignty', which was the right of

[685] UN Watercourses Convention (n 591); Convention on the Protection and Use of Transboundary Watercourses and International Lakes (adopted 17 March 1992, entered into force 6 October 1996) 1936 UNTS 269; ILM 1312 (UNECE Water Convention) See Chapter 3.3.2 regarding opening the UNECE Water Convention to accession by all UN members.
[686] ILC, 'Second report on the law of the non-navigational uses of international watercourses, by Mr. Jens Evensen, Special Rapporteur' (1984) UN Doc A/CN.4/381, para 3

states to utilize water resources within their borders provided they did not 'cause damage or harm to the rights and interests of other States'.[687] In fact, Eversen removed the term 'shared natural resource' altogether from the draft agreement because he felt that retaining it would not be 'conducive to the attainment of a generally acceptable convention'.[688] Given the complaints being voiced by states, Eversen rightly observed that the convention would involve both political and legal considerations.[689] The draft of the convention presented to the UNILC in 1984 contained several changes from prior drafts that attempted to assuage concerns about infringements on sovereignty while continuing to establish limits on exercise of that sovereignty.

Perhaps most significantly, the 1984 draft included for the first time an article allowing a state to enjoy 'a reasonable and equitable share of the uses' of water in its territory.[690] In a reflection of the impact of the Helsinki Rules, the draft also expanded on the list of factors to be contemplated when determining what is reasonable and equitable[691] that had been introduced in the first report in 1983[692]. Mirroring the draft article presented in 1983, the principle of not harming a neighbor's water resources was expressed as a 'prohibition against activities . . .causing appreciable harm'.[693] In spite of a rejection of the concept of shared natural resources, the 1984 draft continued to stress cooperation among watercourse states in order to 'preserve and protect' the resource while achieving 'optimum utilization'.[694] The cooperation was to be 'exercised on the basis of the equality, sovereignty and territorial integrity of all the watercourse States concerned'.[695] Joint management commissions were strongly encouraged as mechanisms to ensure cooperation among states sharing a watercourse.[696]

[687] ibid para 47
[688] ibid para 48
[689] ibid para 18
[690] ibid para 49, draft art 6(1)
[691] ibid para 55, draft art 8
[692] ibid fn 36
[693] ibid para 57
[694] ibid para 59
[695] ibid para 64
[696] ibid 75-65, draft art 15

The principle of prior notification of planned activities occupied four of the draft articles[697], and the draft also mandated data collection and sharing[698]. Draft articles on environmental protection contained strong, compulsory obligations for states to act 'individually and through coordinated efforts' to guard against 'unreasonable impairment' and to protect the 'aquatic environment' and 'the environment of the sea'.[699] To reduce the scope of the convention, the draft deleted references to 'watercourse systems', preferring instead to refer simply to 'international watercourses'.[700] Although Jens Eversen recognized that groundwater resources were becoming increasingly important, he opined that the convention should neither include groundwater 'in its general domain' nor feature any special provisions relating to groundwater.[701]

In 1985 Stephen McCaffrey assumed the role of Special Rapporteur when Jens Eversen was elected to the ICJ in 1984.[702] In his second report to the UNILC[703], McCaffrey included a summary of the UNILC's prior deliberations on the forthcoming watercourses convention. In addition, he presented a thorough history of the development of both the principle of equitable utilization of watercourses and the principle of *sic utere tuo* and concluded that

> there is overwhelming support for the doctrine of equitable utilization as a general, guiding principle of law for the determination of the rights of States in respect of the non-navigational uses of international watercourses.[704]

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[697] ibid paras 67-74, draft arts 11-14
[698] ibid para 77, draft art 16
[699] ibid para 82, draft art 20. The reference to the environment of the sea may have resulted from the fact that LOSC was concluded and opened for signature in 1982, only two years before the report.
[700] ibid paras 23, 24
[701] ibid para 30
[702] ILC, 'Preliminary report on the law of the non-navigational uses of international watercourses, by Mr. Stephen C McCaffrey, Special Rapporteur' (1985) UN Doc A/CN.4/393, para 1
[703] ILC, 'Second report on the law of the non-navigational uses of international watercourses, by Mr. Stephen C McCaffrey, Special Rapporteur' (1986) UN Doc A/CN.4/399 and Add. 1 and 2
[704] ibid para 169

After establishing the primacy of equitable utilization, he then declared that

> [t]he bedrock upon which the doctrine of equitable utilization is founded is the fundamental principle represented by the maxim *sic utere tuo ut alienum non laedas.* . . . Thus the States are referred to as having "equal" or, perhaps more accurately, "correlative" rights in respect of use of the watercourse, a concept which finds expression in the doctrine of limited territorial sovereignty: a State has the sovereign right to make whatever use it wishes of waters within its territory, but that right is limited by the duty not to cause injury to other States.[705]

Hence, according to this interpretation, equitable utilization is the guiding principle for governance of land-based watercourses, but the foundation of that principle is *sic utere tuo.* One could question which principle thus takes primacy, and one could also suggest that Stephen McCaffrey may have been attempting to diffuse a volatile debate by giving each of the two main principles equal weight. McCaffrey described the Solomonic solution being sought by suggesting that 'equitable allocation involves striking a balance between the needs of the States concerned in such a way as to maximize the benefit, and minimize the detriment, to each'.[706] In his estimation both principles are expressions of limited territorial sovereignty, and each is the reciprocal of the other. However, in the end the principle of equitable utilization was given a higher priority by the Special Rapporteur when McCaffrey stated that 'in the context of watercourses, suffering even significant harm may not infringe the rights of the harmed State if the harm is within the limits allowed by an equitable allocation'.[707]

In each successive report Stephen McCaffrey proposed a set of draft articles for the convention. McCaffrey's seventh and final report containing a full draft

[705] ibid para 171
[706] ibid para 175
[707] ibid para 181

convention was submitted to the UNILC in 1991[708], and in that report the Special Rapporteur urged the UNILC to define the term 'international watercourse' to embrace international watercourse systems that 'constitute a unitary whole'[709], a scope that would include associated groundwater[710]. In fact, the bulk of the report was devoted to groundwater[711], in an obvious attempt to bring that resource within the ambit of the forthcoming convention. After presenting two alternative definitions of 'watercourse system'[712], McCaffrey announced that the task of drafting articles for the convention has been completed[713]. In its 1991 session the UNILC provisionally adopted a draft of the convention on first reading,[714] and the draft articles included now-familiar limitations on sovereignty such as equitable and reasonable use, a prohibition against appreciable harm, mandatory cooperation, notification of planned measures and ecosystem protection.

Special Rapporteur Robert Rosenstock replaced Stephen McCaffrey in 1992 after the first reading of the watercourses convention[715], and in his first report in 1993 he explained that the term 'appreciable harm' had been replaced by 'significant harm' since the term 'appreciable' could be interpreted as meaning both 'measurable' and 'significant', and the drafters intended to convey a sense of significant harm.[716] Another interpretation could be that, in replacing 'appreciable harm' with 'significant harm', a level of 'appreciable' harm would be tolerated under the convention, and harm would only be actionable when it reached the stage of being significant. In addition, the article reflecting the principle of *sic utere tuo* no longer prohibited states from causing significant

[708] ILC, 'Seventh report on the law of the non-navigational uses of international watercourses, by Mr. Stephen C McCaffrey, Special Rapporteur' (1991) UN Doc A/CN.4/436
[709] ibid para 9
[710] ibid para 15
[711] ibid paras 17-49
[712] ibid para 85
[713] ibid para 86
[714] ILC, 'Report of the International Law Commission on the work of its forty-third session (29 April-19 July 1991) UN Doc A/46/10, para 59
[715] ILC, 'Report o f the International Law Commission on the work of its forty-fourth session (4 May-24 July 1992)' (1992) UN Doc A/47/10, para 350
[716] ILC, 'First report on the law of the non-navigational uses of international watercourses, by Mr. Robert Rosenstock, Special Rapporteur' (1993) UN Doc A/CN.4/451, para 12

harm but rather mandated only a level of due diligence not to cause significant harm, except where the harm followed from a validly equitable and reasonable use. However, any use creating significant harm from pollution was presumed to be inequitable and unreasonable.[717] In this way, the principle of equitable and reasonable use would be enshrined as 'the determining criterion'[718], trumping the principle of *sic utere tuo* except in cases of significant harm caused by pollution.

The final text of the convention weakened the principle of *sic utere tuo* even further by reducing the due diligence requirement to a requirement that states 'take all appropriate measures to prevent the causing of significant harm to other watercourse States'[719] and by eliminating the exception for pollution. If significant harm should result, then the offending state 'shall . . .take all appropriate measures . . . to eliminate or mitigate such harm and, where appropriate, to discuss the question of compensation'.[720] However, the obligation to take all appropriate measures is modified by a provision allowing the offending state, when determining a proper course of action, to have 'due regard' for Articles 5 and 6, which are the articles setting for the principle of equitable and reasonable utilization.[721] Through these provisions, the principle of no significant harm was even more firmly subordinated to the principle of equitable and reasonable use, and one can easily infer that the preference arose from a desire to support economic growth and development. According to Ximena Fuentes, the comparative levels of economic development of the states should not be a criterion in determining equitable utilization, but the relative social and economic needs of the parties represent an important factor to be weighed.[722] In this balancing act, faithful exercise of the principle of equitable utilization can lead to inefficient, and even wasteful, use of the resource, since

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[717] ibid para 27
[718] ibid para 22
[719] UN Watercourses Convention (n 591) art 7(1)
[720] ibid art 7(2)
[721] ibid
[722] Ximena Fuentes, 'The Criteria for the Equitable Utilization of International Rivers' (1997) 67 British Yearbook of International Law 337, 344

efficiency is only a desirable, but not mandatory, outcome[723] and 'sovereignty is ranked lower than the criterion of need'[724]. In a race to exploit the common resource, all sides can lose.

The legal journey to the dominance of the principle of equitable and reasonable use began with *Trail Smelter*, which favored economic development by allowing a state to cause transboundary harm subject only to an obligation to compensate the damaged state.[725] By 1994 that journey had led to a philosophical position where a state was entitled to utilize watercourses within its borders subject only to an obligation to avoid significant harm to a neighboring state by taking such measures that it may deem to be appropriate. One could argue that in deciding that no action would be appropriate a state would not be in breach of the provisions of the convention. However, should a state's inaction result in significant harm to a neighbor, then the offending state would be in breach of its due diligence obligation to prevent significant transboundary harm.[726]

Like Stephen McCaffrey, Robert Rosenstock believed that groundwater had not been adequately covered in the draft text. At the very beginning of his tenure as Special Rapporteur, Rosenstock suggested that confined aquifers not connected to surface water systems should also be included in the scope of the forthcoming convention[727], and the UNILC invited Rosenstock to provide more information on the topic[728]. In 1993 he included a six-page annex to his second

[723] ibid 393
[724] ibid 392
[725] *Trail Smelter (US v Canada),* 3 RIAA 1911 (1938, 1941)
[726] Attila Tanzi and Alexandros Kolliopoulos, 'The International Water Law Process and Transboundary Groundwater: Supplementing the Water Convention with the 2012 UNECE Model Provisions' in Attila Tanzi and others (eds), *The UNECE Convention on the Protection and Use of Transboundary Watercourses and International Lakes: Its Contribution to International Water Cooperation International Water Law Series 4* (Brill 2015) 413, 418
[727] ILC, First report on the law of the non-navigational uses of international watercourses, by Mr. Robert Rosenstock, Special Rapporteur (n 708) para 11
[728]ILC, 'Second report on the law of the non-navigational uses of international watercourses, by Mr. Robert Rosenstock, Special Rapporteur' (1994) UN Doc A/CN.4/462, Annex "Unrelated" Confined Groundwaters para 2

report devoted to '"Unrelated" confined groundwaters'[729], that explained the significance and movement of groundwater and summarized the 'scanty'[730] law addressing transboundary aquifers. Rosenstock defined the term 'confined groundwaters' as groundwater that is unrelated to surface water, does not flow into a common terminus with surface water and is 'completely enclosed'.[731] His use of the word 'confined' in this context has led to some confusion, because the term 'confined aquifer' in a hydrogeological context refers to an aquifer formation that is sandwiched between confining layers, such as semi-permeable aquitards and impermeable aquicludes. The same aquifer can have both confined and unconfined sections, and the unconfined section of that aquifer could indeed be related to surface water.[732] Thus, for scientists the term 'confined groundwaters' refers to the water in an aquifer that is between confining layers, which could or could not encompass the entire aquifer. Even though the term 'confined groundwaters' was not used in a technically correct manner, the UNILC adopted Rosenstock's understanding of 'confined' for purposes of the UN Watercourses Convention and for its later work on aquifers that will be discussed in Chapter 3.4.2.

Robert Rosenstock's attempt to include confined groundwaters in the scope of the UN Watercourses Convention ultimately failed. Instead of expanding the convention to include confined groundwaters, the UNILC adopted the Resolution on Confined Transboundary Groundwater, recommending that states be guided by the convention in 'regulating transboundary groundwater' and that they enter into agreements regarding groundwaters that were consistent with the convention.[733]

[729] ibid
[730] ibid para 10
[731] ibid para 3
[732] Kevin M Hiscock and Victor F Bense, *Hydrogeology Principles and Practice* (2d ed, Wiley Blackwell 2014)
[733] ILC, 'Report of the International Law Commission on the work of its forty-sixth session' (2 May-22 July 1994) UN Doc A/49/10, para 222

Nearly forty years after requesting a study on the law of freshwater resources, the UNGA adopted the UN Watercourses Convention on 21 May 1997.[734] The convention would not come into effect for another seventeen years, until Vietnam launched its entry into force on 21 August 2014[735] by becoming the thirty-fifth ratifying state[736]. In truth, in spite of a gestation spanning fifty-five years, the UN Watercourses has achieved only a tepid following, almost exclusively in Europe, Africa and the Middle East.[737] Not surprisingly, the major stumbling block to full acceptance has been constructed of arguments over the priority to be given to equitable and reasonable utilization, which is generally favored by upstream states, and the priority to be given to the no significant harm principle, which is generally favored by downstream states.[738] Salman Salman has rightly observed that the relationship between these two principles has been 'the major area of debate on international water law for the last half a century'[739], and he also maintains that

> the prevailing view is that the Convention has, like the Helsinki Rules, subordinated the obligation not to cause significant harm to the principle of equitable and reasonable utilization.[740]

Not even the convention's directions to 'protect and preserve' ecosystems[741] and to 'prevent, reduce and control' pollution[742] lend enough support to the no significant harm principle to tip the balance in its favor, for states are only

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[734] UNGA Res 51/229 (8 July 1997). One hundred three states voted in favor of the resolution, three were opposed, and twenty-seven abstained.
[735] Convention on the Law of the Non-Navigational Uses of International Watercourses (*United Nations Treaty Collection)* <https://treaties.un.org/pages/viewdetails.aspx?src=ind&mtdsg_no=xxvii-12&chapter=27&lang=en> accessed 28 January 2018.
[736] UN Watercourses Convention (n 591) art 36(1)
[737] Salman 2015 (n 543) 8. As of 28 January 2018, the UN Watercourses Convention has thirty-six parties.
[738] ibid 8
[739] Salman 2007 (n 531)
[740] ibid 633. See also Salman 2015 (n 543) 6
[741] UN Watercourses Convention (n 591) art 20
[742] ibid art 21(2)

obliged to act 'where appropriate'[743]. Salman Salman has opined that equitable utilization protects quantity and no significant harm protects quality of freshwater,[744] although significant harm can also result from diversions that cause a decrease in water quantity. In a world where both upstream and downstream states seek development and where both quantity and quality of water are critical, the lines between the two principles may blur.

While not achieving global acceptance on a political scale, the UN Watercourses Convention has been hailed as a concise reflection of customary international law regarding non-navigable uses of international watercourses that is therefore binding on non-signatories.[745] Indeed, all of the customary principles that emerged in freshwater law after WWII can be found in the UN Watercourses Convention. As discussed, the Helsinki Rules concept of equitable and reasonable utilization features prominently in the convention[746]. The restriction on significant transboundary harm merged with the *Lake Lanoux* instruction to consider all interests of a neighboring state, the Stockholm Principle 21 instruction not to cause damage to a neighbor's environment and the prevailing theme to support development. The result was an obligation to 'take all appropriate measures to prevent the causing of significant harm to other watercourse States' when utilizing an international watercourse that lies on domestic territory.[747] Laurence Boisson de Chazournes calls these twin obligations – equitable and reasonable utilization and no significant harm -- the 'water sharing principles' and views them as one of the four pillars of the UN Watercourses Convention.[748] In addition, the convention includes the obligation found in CERDS, *Corfu Channel* and *Lake Lanoux* to communicate about planned measures with a potentially adverse effect on a neighboring state[749], as well as

[743] ibid arts 20 and 21(2)
[744] Salman 2007 (n 531) 239
[745] Salman 2015 (n 543) 11
[746] UN Watercourses Convention (n 591) art 5
[747] ibid art 7
[748] Boisson de Chazournes (n 569) 30. In her opinion, the other three pillars are a general obligation to cooperate, an obligation to protect the environment and 'promotion of dispute settlement and dispute avoidance mechanisms'. ibid 30-31
[749] UN Watercourses Convention (n 591) art 11, 12

the *Trail Smelter* and *Nuclear Weapons* restriction on significant harm from transboundary pollution[750], which Franz Xaver Perrez says 'may be considered a rule of customary law'[751].

According to Eyal Benvenisti, the inclusion of the twin obligations in the UN Watercourses Convention led to an 'extremely divisive debate' in the UNILC and the UN Sixth Committee between those who wanted to retain a vague standard of behavior embodied in the principle of equitable and reasonable utilization and those who wanted a clear standard embodied in the principle of no significant harm.[752] Generally speaking, upstream states preferred the more vague standard that allowed them greater utilization of water resources, and downstream states wanted to be protected from significant harm caused by pollution and over-abstraction.[753] The final text evidences an attempt to find a compromise between these two camps.[754] Applying *sic utere tuo* with respect to shared freshwater manifests a recent development in the evolution of treaty limitations on sovereignty, and in their user's guide to the UN Watercourses Convention Alistair Rieu-Clarke, Ruby Moynihan and Bjørn-Oliver Magsig acknowledge that the principle of no significant harm features only in more modern transboundary water agreements[755].

3.3.2 The UNECE Water Convention and protection from harm

Five years before the UN Watercourses Convention was adopted by the UNGA, the UN Economic Commission for Europe (UNECE) produced it own

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[750] ibid art 21
[751] Franz Xaver Perrez, 'The Relationship Between "Permanent Sovereignty" and the Obligation Not To Cause Transboundary Environmental Damage' (1996) 26 Environmental Law 1187, 1200
[752] Eyal Benvenisti, *Sharing Transboundary Resources: International Law and Optimal Resource Use* (Cambridge University Press 2002) 163 (Benvenisti 2002)
[753] Renee Martin-Nagle, 'Fossil Aquifers: A Common Heritage of Mankind' (2011) 2 Journal of Energy and Environmental Law 39, 46. *See also* ILC, 'Shared natural resources: first report on outlines, by Mr. Chusei Yamada, Special Rapporteur'' (2003) UN Doc A/CN.4/533 (2003) para 10-11
[754] Benvenisti 2002 (n 752) 167
[755] Alistair Rieu-Clarke, Ruby Moynihan, and Bjørn-Oliver Magsig, *UN Watercourses Convention: User's Guide* (IHP-Help Centre for Water Law, Policy & Science 2012) 117

contemporary water-related treaty: the Convention on the Protection and Use of Transboundary Watercourses and International Lakes (also called the Helsinki Convention or the UNECE Water Convention).[756] Adopted in 1992, the treaty entered into force in 1996, only four years after its adoption, and currently has forty-one parties[757] – five more than the UN Watercourses Convention. Why did the UNECE Water Convention achieve such rapid acceptance, while the UN Watercourses Convention languished in legal and political wilderness for nearly twenty years? One reason must certainly be the geographically more limited and politically more cohesive group of parties to the UNECE Water Convention. One might also infer that the treaty's promotion of greater environmental protection resonated with the parties more than the development-focused set of principles promoted by the UN Watercourses Convention.

The UNECE was established in 1947 as one of five regional commissions of the UN whose purpose was to achieve economic integration.[758] Now numbering fifty-six, its members are drawn from Europe, North America and Central Asia. Initially, only UNECE members were eligible to join the UNECE Water Convention. In 2003 the parties to the UNECE Water Convention agreed to open the treaty to any UN member[759], so that, as of 6 February 2013[760] any UN member has the choice of joining the UNECE Water Convention, the UN Watercourses Convention, or both.

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[756] UNECE Water Convention (n 685) For a thorough analysis of the UNECE Water Convention, see Attila Tanzi and others (eds), *The UNECE Convention on the Protection and Use of Transboundary Watercourses and International Lakes* (Brill 2015)

[757] Convention on the Protection and Use of Transboundary Watercourses and International Lakes (*UN Treaty Collection*) <https://treaties.un.org/Pages/ViewDetails.aspx?src=TREATY&mtdsg_no=XXVII-5&chapter=27&clang=_en> accessed 28 January 2018

[758] Mission (*UNECE*) <https://www.unece.org/mission.html> accessed 28 January 2018

[759] Decision III/1, ECE/MP.WAT/14 of 28 November 2003, Amendment to the Water Convention (2003)

[760] Adoption of Amendments, Depositary notification C.N.150.2004.TREATIES-1 (24 February 2004, re-issued on 10 March 2004). In January 2016, Iraq became the first, and thusfar only, non-UNECE state to indicate a desire to accede to the UNECE Water Convention. 'Iraq confirms progress towards accession to the UNECE Water Convention in 2016' (*UNECE*) <http://www.unece.org/info/media/news/environment/2016/iraq-confirms-progress-towards-accession-to-the-unece-water-convention-in-2016/doc.html > accessed 27 February 2018

The provisions of the UNECE Water Convention evidence a clear preference for the no significant harm principle.[761] For example, after defining 'Transboundary waters'[762] and 'Transboundary impact'[763], the convention immediately states that the 'Parties shall take all appropriate measures to prevent, control and reduce any transboundary impact'.[764] Like the UN Watercourses Convention, the UNECE Water Convention obliges only that a state take 'all appropriate measures', and the UNECE Water Convention likewise uses the term 'significant' in defining 'transboundary impact' as 'any significant adverse effect on the environment'.[765] However, unlike the UN Watercourses Convention, the UNECE treaty includes a long list of possible effects on the environment that would activate the treaty.[766] The UNECE Water Convention defines transboundary waters broadly as 'any surface or ground waters which mark, cross or are located on boundaries between two or more States'[767], thus including in its scope surface water, confined and unconfined transboundary aquifers, and related and unrelated groundwater[768]. The UNECE Water Convention specifically excludes offshore waters, by stating that 'wherever transboundary waters flow directly into the sea, these transboundary waters end at a straight line across their respective mouths between points on the low-water line of their banks'.[769] While offshore freshwater resources do not fall within the scope

[761] 'Where there is no perfect coincidence between the contents of the rules on the same subject matter of the two Conventions, those of the UNECE Convention generally appear to be more detailed and stringent than those of the UN Watercourses Convention with respect to the substantive obligation of harm prevention.' Attila Tanzi, Owen McIntyre and Alexandros Kolliopoulos, 'The Contribution of the UNECE Water Convention to International Water Law', in Attila Tanzi and others, *The UNECE Convention on the Protection and Use of Transboundary Watercourses and International Lakes: Its Contribution to International Water Cooperation International Water Law Series 4* (Brill 2015) 538
[762] UNECE Water Convention (n 685) art 1(1)
[763] ibid art 1(2)
[764] ibid art 2(1)
[765] ibid art 1(2)
[766] ibid art 1(2)
[767] ibid art 1.1
[768] Attila Tanzi, 'Furthering International Water Law or Making a New Body of Law on Transboundary Aquifers? An Introduction' (2011) 13 International Community Law Review 193, 198 (Tanzi 2011)
[769] ibid

of the UNECE Water Convention, the convention does contemplate cooperation with coastal states that are significantly affected by transboundary impacts.[770]

As discussed earlier, in the UN Watercourses Convention the principle of equitable and reasonable use occupies a prominent position and is viewed as the lynchpin of the entire convention. That principle appears in the UNECE Water Convention but with a different invocation, as states agree to take all appropriate measures to

> ensure that transboundary waters are used in a reasonable and equitable way, taking into particular account their transboundary character, in the case of activities which cause or are likely to cause transboundary impact. [771]

Rather than repeating the Helsinki Rules pattern of listing the factors to be weighed in determining whether a use is equitable and reasonable, the UNECE Water Convention instead provides twelve concrete measures for states to follow in order 'to prevent, control and reduce transboundary impact'.[772] Avoidance of transboundary impact is therefore the primary concern when considering whether a use is equitable and reasonable. In giving priority to the no significant harm principle, the UNECE Water Convention obliges its signatories to cede their sovereign rights to engage freely in domestic activities that have transboundary effects in order to protect neighboring states. As will be explained in further detail in Chapter 5, such voluntary limitations on sovereignty align well with the philosophy of supporting a community of interests in a shared resource.

Unlike the UN Watercourses Convention, the UNECE Water Convention goes even further in limiting sovereignty by including what Ian Brownlie calls

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[770] UNECE Water Convention (n 685) art 9(3), 9(4)
[771] ibid art 2(2)(c)
[772] ibid art 3(1)

'emergent legal principles'[773] – the precautionary principle[774] and the polluter pays principle[775]. While the word 'development' does not appear in the UNECE Water Convention and there is no mention of supporting economic interests or sovereignty, the convention does include verbatim the definition of sustainable development introduced by the Brundtland Report[776]:

> Water resources shall be managed so that the needs of the present generation are met without compromising the ability of future generations to meet their own needs.[777]

Now familiar procedural principles in international water law are also reinforced in the convention, such as data sharing.[778]

Curiously, the treaty contains no obligation to give advance warning of a planned measure to a neighboring state when that activity may have a transboundary impact. Instead, the UNECE Water Convention encourages close cooperation between and among parties, which Alistair Rieu-Clarke calls 'the bedrock of the entire convention'.[779] Multiple provisions sprinkled in the convention speak of harmonized policies[780], bilateral and multilateral research[781], 'widest' exchanges of information[782], bilateral and multilateral agreements to 'embrace relevant issues covered by the Convention'[783], joint

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[773] Brownlie, *Principles of Public International Law* (n 640) 277-280
[774] UNECE Water Convention (n 685) art 2.5.a
[775] ibid art 2.5.b
[776] World Commission on Environment and Development, *Our Common Future* (Oxford University Press 1987) (Bruntland Report) ch I para 27
[777] UNECE Water Convention (n 685) art 2.5.c Brownlie lists sustainable development among the emergent legal principles. Brownlie (n 640) 278-279
[778] UNECE Water Convention (n 685) art 6, 13
[779] Alistair Rieu-Clarke, 'Remarks on the Drafting History of the Convention' in Attila Tanzi and others (eds), *The UNECE Convention on the Protection and Use of Transboundary Watercourses and International Lakes: Its Contribution to International Water Cooperation International Water Law Series 4* (Brill 2015) 14
[780] UNECE Water Convention (n 685) art 2(6)
[781] ibid art 5, 12
[782] ibid art 6
[783] ibid art 9(1)

bodies[784], joint programmes for monitoring and assessment[785], joint communication in critical situations[786] and mutual assistance[787]. The sense of a community of interests involved with the resource extends to the general public, as the parties agree to make available information such as water-quality objectives[788], issued permits[789] and test results[790]. States are expected to adapt existing agreements to 'eliminate the contradictions with the basic principles of this Convention . . . . regarding the prevention, control and reduction of transboundary impact'[791] Thus, the UNECE Water Convention intends that its principles of cooperation and environmental protection will prevail over conflicting principles in other agreements. This approach is in sharp distinction with the UN Watercourses Convention, which states that 'nothing in the present Convention shall affect the rights or obligations of a watercourse State' under agreements entered into prior to becoming a party to the UN Watercourses Convention.[792] Parties merely have to 'consider harmonizing such agreements with the basic principles of the present Convention'.[793]

Clearly the two global water conventions exhibit some major differences in principles and philosophies. The UN Watercourses Convention supports sovereignty of the riparian states by favoring equitable and reasonable utilization over the no harm principle, and the UNECE Water Convention puts greater limitations on exercises of sovereignty by placing greater emphasis on the no harm rule. Attila Tanzi offered an insight into the origins of the differences by observing that the UNECE Water Convention 'does not define "transboundary watercourses", but "transboundary waters"'.[794] From this insight one could logically infer that, when a convention governs the resource

[784] ibid art 9(2), 10
[785] ibid art 11
[786] ibid art 14
[787] ibid art 15
[788] ibid art 16(1)(a)
[789] ibid art 16(1)(b)
[790] ibid art 16(1)(c)
[791] ibid art 9(1)
[792] UN Watercourses Convention (n 591) art 3(1)
[793] ibid art 3(2)
[794] Tanzi 2011 (n 768) 195

instead of its physical attributes, the parties move from protecting sovereign interests to managing a common benefit.

3.3.3 Judicial balancing

The ICJ has not been silent on the principles that should guide governance of shared water resources. In 1997, the same year that the UN Watercourses Convention was opened for signature, the ICJ issued a landmark decision that involved a hydropower project on the Danube, which is a transboundary river. The *Gabcíkovo-Nagymoros Project Case*[795] cited the UN Watercourses Convention as support for the fact that the community of interests principle described in the Permanent Court of International Justice 1929 *River Oder Case* has found a modern incarnation in the principle of equitable and reasonable utilization.[796] The 'no significant harm' principle was not mentioned in the decision, raising a question of whether in 1997 the court recognized it as customary law. Charles Bourne interprets the court's ruling as establishing that

> the protection of the environment has no absolute priority over other considerations, particularly in the case of developments involving the utilization of international watercourses.[797]

Yet, by the time that the ICJ rendered its 2010 decision in the *Pulp Mills Case*[798], which stemmed from pollution of the transboundary River Uruguay, the court, citing *Corfu Channel* and *Nuclear Weapons,* plainly declared:

> A State is thus obliged to use all the means at its disposal in order to avoid activities which take place in its territory, or in any area under its

[795] *Gabcíkovo-Nagymoros Project Case (Hungary v. Slovakia)* (Judgment) (1997) ICJ Rep 4 (*Gabcíkovo-Nagymoros)*
[796] ibid 53
[797] Charles B Bourne, 'The *Case Concerning the Gabčikovo-Nagymoros Project*: An Important Milestone in International Water Law' in Jutta Brunnée and others (eds), *Yearbook of international Environmental Law: Volume 8* (Graham & Troutman 1997) 11
[798] *Pulp Mills on the River Uruguay (Argentina v. Uruguay)* (Judgment) (2010) ICJ Rep 14 (*Pulp Mills*)

> jurisdiction, causing significant damage to the environment of another State. This Court has established that this obligation "is now part of the corpus of international law relating to the environment" (*Legality of the Threat or Use of Nuclear Weapons, Advisory Opinion, I.C.J. Reports 1996 (I)*, p. 242, para. 29).[799]

The *Nuclear Weapons* advisory opinion merely recognized 'the existence of the general obligation of States to ensure that activities within their jurisdiction and control respect the environment of other States'.[800] The court seems to have amplified and extended the *Nuclear Weapons* advisory opinion in citing it to support a state's obligation 'to use all the means at its disposal' to avoid activities that cause significant damage. The *Pulp Mills Case* illustrates that, in the thirteen years between the *Gabcíkovo-Nagymoros Project Case* and the *Pulp Mills Case,* the 'no significant harm' principle regained enough support that the ICJ interpreted its earlier *Nuclear Weapons* decision as declaring the no significant harm principle to be an obligation under international law. With respect to equitable and reasonable utilization, in analyzing the pertinent treaty's obligation for optimum and rational utilization, the court stated that

> . . . the attainment of optimum and rational utilization requires a balance between the Parties' rights and needs to use the river for economic and commercial activities on the one hand, and the obligation to protect it from any damage to the environment that may be caused by such activities, on the other. . . . The Court wishes to add that such utilization could not be considered to be equitable and reasonable if the interests of the other riparian State in the shared resource and the environmental protection of the latter were not taken into account.[801]

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[799] ibid 46
[800] *Legality of the Threat or Use of Nuclear Weapons* (Advisory Opinion) (1996) ICJ Reports 226, 242 (*Nuclear Weapons*)
[801] *Pulp Mills* (n 798) 64, 65

Hence, the ICJ opinion requires a balance between economic and commercial interests and environmental protection, but no mention is made of humanitarian uses.

In 2015 the ICJ issued an opinion to resolve disputes in two cases brought against one another by Costa Rica and Nicaragua for alleged offenses related to waterways in the border region between them that had resulted in transboundary harm.[802] Although Costa Rica's treaty right to navigation in the San Juan River was the only utilization of the waterways that was addressed[803], the court did not take the opportunity to restate and endorse the principle of equitable and reasonable utilization. Instead, aside from resolving boundary claims related to navigation[804], the decision was directed in large part to obligations to prevent significant transboundary harm through Nicaragua's dredging and excavating of canals[805] and Costa Rica's construction of a road next to a shared river[806]. Interestingly, the parties stipulated to several tenets of international environmental law, such as an obligation to conduct an environmental impact assessment when there is risk of significant transboundary harm 'particularly in areas or regions of shared environmental conditions'[807], which the court upheld while citing the *Pulp Mills Case*[808]. The parties also agreed on an obligation of prior notice and consultation when significant transboundary harm could emanate from planned activities.[809] The court upheld Costa Rica's demand for reparation[810], a ruling that follows the judicial lineage dating from *Trail Smelter*. In the strongest of terms, the ICJ clarified one of the procedural obligations related to the principle of no significant harm:

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[802] *Certain Activities Carried Out by Nicaragua in the Border Area (Costa Rica v. Nicaragua)* and *Construction of a Road in Costa Rica along the San Juan River (Nicaragua v. Costa Rica)* (2015) (Judgment) ICJ Reports 665
[803] ibid para 49
[804] ibid para 76, 92, 136
[805] ibid para 63
[806] ibid para 64
[807] ibid para 101
[808] ibid para 104
[809] ibid para 106
[810] ibid para 142

> a State's obligation to exercise due diligence in preventing significant transboundary harm requires that State to ascertain whether there is a risk of significant transboundary harm prior to undertaking an activity having the potential adversely to affect the environment of another State. If that is the case, the State concerned must conduct an environmental impact assessment.[811]

Once again citing the *Pulp Mills Case,* the court ruled that environmental impact assessments must be conducted prior to the start of planned activities and throughout the project.[812] Costa Rica breached this rule of law by studying environmental impacts only after construction of the road.[813]

Tracing development of the legal principles found in the UN Watercourses Convention and the UNECE Water Convention as well as those pronounced by the ICJ reveals a clear list of those agreed principles affecting transboundary surface water. The two main substantive obligations that limit absolute state sovereignty are equitable and reasonable utilization and no significant harm, with the UN Watercourses Convention preferring equitable and reasonable use and the UNECE Water Convention favoring no significant harm. Since the two conventions have roughly the same number of state parties, one cannot yet declare one or the other to be dominant. In the three cases addressing transboundary surface water, the ICJ seemed to drift from favoring equitable and reasonable use in the *Gabcíkovo-Nagymoro Project Case* to supporting no significant harm in the *Pulp Mills Case* and the cases between Costa Rica and Nicaragua. In its February 2018 ruling in the *Costa Rica v. Nicaragua* case, the ICJ for the first time awarded damages for loss of ecosystem services, which seems to indicate a shift toward even greater support for the no significant

[811] ibid para 153
[812] ibid para 161
[813] ibid para 162

harm principle.[814] With respect to procedural obligations for states sharing watercourses, both the UN and UNECE conventions and the ICJ all seem to agree on certain principles: cooperation, prior notice of planned measures, data sharing, environmental protection, and, recently, preparation of environmental impact assessments. These customary obligations can be expected to feature in negotiations for sharing transboundary offshore freshwater resources.

3.4 Transboundary aquifers: shared natural resources or sovereign property?

At this time, the international law principles for surface freshwater are well defined and well recognized, even though the tension continues between those that favor sovereign equitable use and those that favor greater limitations on sovereignty and greater environmental protection. However, the legal principles for land-based aquifers are still in an embryonic stage, in spite of the efforts of the same organizations that served as midwives for the principles governing shared surface water: ILA, the UNILC and the UNECE. In addition to the guidance provided by these organizations, a global group of scholars produced the Bellagio Rules that specifically focused on governance of transboundary aquifers. In contrast to the hundreds of bilateral and multilateral treaties covering shared surface waters, only a handful of treaties have been negotiated for transboundary aquifers. Therefore, although some trends are emerging, state practice is quite limited and provides uncertain precedent. Since some offshore freshwater aquifers will almost certainly be transboundary, a review of the emerging principles for land-based transboundary aquifers may be helpful to policy-makers who may be charged with designing governance regimes for offshore freshwater.

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[814] *Certain Activities Carried Out by Nicaragua in the Border Area (Costa Rica v. Nicaragua)* and *Construction of a Road in Costa Rica along the San Juan River (Nicaragua v. Costa Rica)* (2018) (Judgment) 2 February 2018 General List No. 150, para 42

3.4.1 Scholarly contributions

While the 1966 Helsinki Rules defined an international drainage basin as encompassing 'underground waters'[815], the definition included only underground waters 'that contribute to its principal river, a stream or lake or other common terminus'[816], thus excluding groundwaters unconnected to surface water. Aware of the gap left in governance of freshwater resources, the ILA in 1986 adopted four principles that became known as the Seoul Rules on International Groundwater (Seoul Rules)[817]. Article I used the term 'aquifer' instead of groundwaters and expanded the Helsinki Rules definition of basin states to include states sharing an aquifer when the aquifer forms part of an international basin, even if the aquifer's waters do not connect with surface water flowing into a common terminus.[818] In addition, Article II brought within the ambit of the Helsinki Rules areas of aquifer recharge and discharge that contribute to an international drainage basin[819] as well as shared aquifers that have no connection with surface water.[820] Article II admonished states to 'take into account any interdependence of the groundwater and other waters including any interconnections between aquifers' when 'exercising their rights and performing their duties under international law.'[821] The first two articles of the Seoul Rules thus merely extended application of the Helsinki Rules to aquifers where the aquifer formations lie within an international basin or are intersected by an international boundary or where the recharge or discharge areas contribute to an international drainage basin. Article III likewise extended surface water principles to aquifers by providing that states 'shall

[815] Helsinki Rules (n 595) art II
[816] ibid comment to art II
[817] Seoul Rules (n 607)
[818] ibid art I
[819] ibid art II(1)
[820] ibid art II(2)
[821] ibid art II(3)

prevent or abate the pollution of international groundwaters'[822], 'shall consult and exchange relevant available information'[823] and 'shall cooperate . . . for the purpose of collecting and analyzing additional needed information and data'[824]. The final article, Article IV, went beyond traditional surface water principles by suggesting that states 'consider' integrating surface water management and groundwater management.[825] Six years later at the International Conference on Water and the Environment, this holistic approach was promoted in the Dublin Statement on Water and Sustainable Development as integrated water resource management[826], a doctrine that has achieved global recognition and acceptance. Although the Seoul Rules merely served to extend the Helsinki Rules to aquifers and their recharge and discharge areas, the ILA brought global attention to groundwater governance by issuing the first set of rules dedicated to aquifers.

In 1989, only three years after the ILA issued the Seoul Rules, two additional sets of guidance on transboundary groundwater governance were published. The Bellagio Draft Treaty[827] was produced by a multidisciplinary group of scholars representing hydrogeology, economics, engineering and law that was unaffiliated with any official organization. In addition, the UNECE published its Charter on Groundwater Governance (UNECE Groundwater Charter)[828] that will be discussed in Chapter 3.4.3. Although the Bellagio Draft Treaty and the UNECE Groundwater Charter were both non-binding, their forward-looking approach to groundwater management still deserves mention.

[822] ibid art III(1)
[823] ibid art III(2)
[824] ibid art III(3)
[825] ibid art IV
[826] 'The Dublin Statement and Report of the Conference', International Conference on Water and the Environment, Dublin, Ireland (World Meteorological Organization 1992)
[827] Robert D Hayton and Albert E Utton, 'Transboundary Groundwaters: The Bellagio Draft Treaty' (1989) 29 Natural Resources Journal 663
[828] UNECE, 'Charter on Groundwater Management' (1989) UN Doc. E/ECE/1197 ECE/ENVWA/12 (UNECE Charter on Groundwater Management)

The precursor and model for the Bellagio Draft Treaty was the 1985 Ixtapa Draft Agreement[829], which was produced by a group of water professionals who had grown concerned about increasing competition for transboundary groundwater resources, particularly along the US-Mexico border, and presented guidelines for groundwater use to fill a void in international water law. Molded by meetings of global experts over several years after publication of the Ixtapa Draft Agreement[830], the 1989 Bellagio Draft Treaty continued to use shared groundwater along the US-Mexico border as a reference but expanded the scope of the Ixtapa guiding principles to include other transboundary aquifers.[831] According to the authors, the draft treaty was 'based on the proposition that water rights should be determined by mutual agreement rather than be the subject of uncontrolled, unilateral taking . . .'[832] with a goal 'to achieve joint, optimum utilization of the available waters'[833]. They highlighted three overriding concepts that were intended to safeguard sovereign interests: control should be 'asserted' only in zones of excess withdrawals or impending contamination; oversight and facilitation powers would be granted to an international agency with enforcement being left to domestic agencies, and the international agency would have little 'substantive discretion' but would 'take the initiative, subject to the Governments' approval, in preparing for and confronting the full range of problems involving the Parties' transboundary groundwaters.'[834] The Bellagio Draft Treaty called for establishment of an international agency, called the Commission, which was given broad powers to 'declare Transboundary Groundwater Conservation Areas, Drought Alerts, Drought Emergencies and Public Health Emergencies, and to promulgate the corresponding plans and Depletion Plans'.[835] Similar to the US-Mexico

[829] Ann Berkley Rogers & Albert E Utton, 'The Ixtapa Draft Agreement Relating to the Use of Transboundary Groundwaters' (1985) 25 Natural Resources Journal 715; Hayton and Utton (n XX) 665
[830] Hayton and Utton (n 827) 666
[831] ibid 668
[832] ibid 664
[833] ibid 665
[834] ibid 664-665
[835] ibid 684 draft art III(3)

International Boundary and Water Commission that served as its inspiration[836], the Commission would be given a staff[837] whose costs would be shared by the relevant states[838]. The draft treaty binds the parties to cooperate in avoiding 'appreciable harm'[839], and, while the words 'equitable and reasonable use' do not appear, the treaty does list factors to be considered in allocating 'water uses' that are not dissimilar to the factors introduced by the Helsinki Rules[840]. Indeed, the entire structure envisioned by the treaty was intended to ensure rational utilization and to protect the quality and quantity of groundwater in an aquifer while also promulgating holistic, conjunctive management of both groundwater and surface water[841]. The treaty also features familiar procedural principles such as data sharing[842] and prior notice of planned measures that might impact the quality of transboundary groundwaters[843]. The Bellagio Draft Treaty supports regional cooperation and management of an aquifer and its waters, with the Commission serving the states sharing the transboundary aquifer. As will be shown in Chapter 3.4.4, the few treaties regarding transboundary aquifers that have been completed all feature a joint body. In this way, the Bellagio Draft Treaty may have left a lasting legacy, although the joint bodies created thus far have not been granted the same breadth of authority and function that the Bellagio Draft Treaty proposed.

In 2004 the ILA once again issued scholarly work on freshwater resources. The Berlin Rules,[844] published after ten drafts[845], include both surface waters and groundwaters in their scope[846], and seven of the seventy-three articles are

[836] ibid 665
[837] ibid 684 draft art III(2)
[838] ibid 684 draft art III(5)
[839] ibid 691 draft art VI(1)
[840] ibid 696 draft art VIII(3)
[841] ibid 688 draft art V(2)(d), 696 draft art VIII(2)(e), and 706 draft art XII(3)(b)(1)
[842] ibid 687 draft art V
[843] ibid 691 draft art VI(2)
[844] Water Resources Committee, 'Fourth Report' in International Law Association Report of the Seventy-First Conference (Berlin 2004) (International Law Association 2004) 334, 340
[845] ibid 336
[846] ibid 343 art 1(1)

devoted to groundwaters[847]. The lead authors of the Bellagio Draft Treaty, Robert Hayton and Albert Utton, were part of the drafting process, but neither of them was a member of the Water Resources Committee at the time of the final publication of the Berlin Rules[848]. Intended as a 'comprehensive revision of the Helsinki Rules' that integrated 'the traditional rules regarding transboundary waters with rules derived from the customary international environmental law and international human rights law'[849] as well as a step toward 'progressive development of the law needed to cope with emerging problems of international or global water management for the twenty-first century'[850], the Berlin Rules presented articles on integrated management[851], sustainability[852], minimization of environmental harm[853], cooperation[854], equitable utilization[855], no significant harm[856], exchange of information[857] and notification of planned measures[858].

The aquifer-specific provisions in the Berlin Rules encompass all types of aquifers regardless of connection to surface water[859], mandate conjunctive management with surface water[860], promote a precautionary approach to sustainable use[861], and require monitoring[862] and protection of the aquifer from pollution[863]. Transboundary aquifers were the subject of a separate article that began with a definition that included aquifers 'connected to surface waters that are part of an international drainage basin'[864] and aquifers 'intersected by the

[847] ibid 384-390 arts 36-42
[848] ibid 335
[849] ibid 337
[850] ibid 338
[851] ibid 351 art 6
[852] ibid 352 art 7
[853] ibid 355 art 8
[854] ibid 360 art 11
[855] ibid 361 art 12
[856] ibid 364 art 16
[857] ibid 399 art 56
[858] ibid 400 art 57
[859] ibid 384 art 36
[860] ibid 385 art 37
[861] ibid art 38
[862] ibid 386 art 39
[863] ibid 387 art 41
[864] ibid 389 art 42(1)(a)

boundaries between two or more States'[865]. Since there is no requirement that the transboundary aquifer be on land, transboundary offshore aquifers would presumably come within the scope of the non-binding Berlin Rules. States sharing transboundary aquifers were advised to manage the aquifer in its entirety where 'possible and appropriate'[866], exchange data[867], cooperate in ensuring equitable utilization[868] and in managing aquifer recharge[869], and refrain from acts that cause significant harm to another state[870]. Unfortunately, although the efforts of the ILA Water Resources Committee produced valuable scholarship[871], the Berlin Rules provoked controversy, leading to a dissent from members of the committee who objected to inclusion of domestic as well as international waters and to subordination of the principle on equitable and reasonable use to the principle of no significant harm[872].

3.4.2 The UNILC and the Draft Articles on the Law of Transboundary Aquifers

As described in Chapter 3.3.1, during his tenure as the fifth and final Special Rapporteur for the UN Watercourses Convention Robert Rosenstock advocated for including confined groundwaters in the scope of the convention. The UNILC rejected his proposal, but he did not abandon his attempts to provide legal guidance on this critical type of freshwater resource. In 2000 Rosenstock was still a member of the UNILC, and he resurrected the topic of shared natural resources by suggesting that the UNILC include the matter in its long-term

[865] ibid art 42(1)(b)
[866] ibid art 42(2)
[867] ibid art 42(3)
[868] ibid art 42(4)
[869] ibid art 42(5)
[870] ibid art 42(6)
[871] For example, the Second Report of the ILA's Water Resources Committee, presented in 2000, included the *Campione Consolidation of the ILA Rules on International Water Resources*, which is a summary the work of the ILA from 1966 through 1999 regarding freshwater resources. Committee on Water Resources Law, 'Second Report' *Report of the Sixty-Ninth Conference: London* (International Law Association, London 2000) 3-28.
[872] Water Resources Committee Report, Dissenting Opinion (ILA Conference Berlin, 9 August 2004) <https://www.internationalwaterlaw.org/documents/intldocs/ILA/ILABerlinRulesDissent2004.pdf> accessed 28 January 2018

agenda of work.[873] Grounding the study in the need for 'optimal use of resources' for sustainable development, the former Special Rapporteur recommended focusing 'exclusively on water, particularly confined groundwater, and such other single geological structures as oil and gas'.[874] Reasoning that consideration of general environmental matters and the global commons would burden the analyses with complexities, Rosenstock suggested limiting the commission's work to 'natural resources within the jurisdiction of two or more States'.[875] In the proposed outline for the study, he listed the legal principles to be addressed, which mirrored the principles reflected in the UN Watercourses Convention and international customary principles for water law: equitable and reasonable utilization and participation (including the factors for determining what is equitable and reasonable utilization), prevention and abatement of significant harm, exchange of data and information, joint management mechanisms, and non-discrimination.[876]

Having been prompted by Robert Rosenstock to return to its unfinished work on transboundary confined groundwaters, the UNILC in 2002 decided to include shared natural resources in its programme of work, to select a Special Rapporteur and to create a working group to assist the Special Rapportur.[877] Chusei Yamada was selected as the first and only Special Rapporteur for the UNILC's work on transboundary groundwaters.[878] As a result of Rosenstock's suggestion in 2000 to include confined groundwaters and similar shared natural resources in the long-term work of the UNILC, transboundary 'confined' groundwater was initially linked with oil and gas in the UNILC's work on shared natural resources. In his first report to the UNILC in 2003, Yamada presented a proposed outline and timeline of the work, announcing that he intended to

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[873] ILC, 'Shared natural resources of States ' in Annex, 'Report of the International Law Commission on the work of its fifty-second session' (1 May–9 June and 10 July–18 August 2000) UN Doc A/55/10, 141
[874] ibid
[875] ibid
[876] ibid
[877] ILC, 'Report of the International Law Commission on the work of its fifty-fourth session' (29 April–7 June and 22 July–16 August 2002) UN Doc A/57/10, para 518(a)
[878] ibid para 519

produce a report on confined groundwaters in 2004 and a report on oil and gas in 2005.[879] The work of producing a set of draft articles on groundwaters would ultimately occupy three years instead of one, and, as will be explained later, the work of codifying oil and gas law would be indefinitely postponed.

In his first report, Chusei Yamada acknowledged that the UNILC's use of the term 'confined groundwater' to mean groundwater unrelated to international watercourse was not consistent with the definition used by hydrogeologists.[880] He also distinguished between international aquifers and transboundary aquifers, with the former being 'part of a system where groundwater interacts with surface water that is at some point intersected by a boundary' and the latter being 'a groundwater body that is intersected by a boundary itself'.[881] The study led by Yamada and whose concept of transboundary aquifer was ultimately adopted included only transboundary aquifers, thereby limiting the scope of the draft articles by excluding several types of transboundary groundwater.

Neither the UN Watercourses Convention nor the UN Draft Aquifer Articles covers all types of transboundary aquifers. In 2003 father and son Yoram and Gabriel Eckstein published an article that presented six models where 'ground water resources can have transboundary implications'.[882] Only two of the six scenarios identified by the Ecksteins fall within the scope of the UN Watercourses Convention – an unconfined transboundary aquifer is hydraulically connected to a river that flows to a common terminus with the aquifer waters and the river serves as a boundary line between two states[883],

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[879] ILC, 'First report on shared natural resources: outlines, by Mr Chusei Yamada, Special Rapporteur' (2003) UN Doc A/CN.4/533 and Add 1, para 4 (Yamada 2003 Report)
[880] ibid para 30 In the definitions section of the report, 'confined aquifer' is defined as an 'Aquifer overlain and underlain by an impervious or almost impervious formation and in which the groundwater is stored under a confining pressure', which is consistent with the hydrogeological definition. ibid Annex I
[881] ibid para 38
[882] Gabriel Eckstein and Yoram Eckstein, 'A Hydrogeological Approach to Transboundary Ground Water Resources and International Law' (2003) 19 American University International Law Review 201
[883] ibid 236

and an unconfined transboundary aquifer is hydraulically connected to a river that flows to a common terminus with the aquifer waters and a border separates the states into upstream and downstream states[884]. The remaining four types of transboundary aquifers identified by the Ecksteins are outside the scope of the UN Watercourses Convention: an unconfined transboundary aquifer flows across an international border but is hydraulically connected to a purely domestic river[885]; an unconfined aquifer is located entirely within a downstream state but is hydraulically connected to a river in an upstream state[886]; a transboundary confined aquifer has a recharge zone that is located in only one state[887], and a transboundary aquifer may be confined or unconfined but is not hydraulically linked to any surface water and receives no recharge[888]. Given the exclusion of international aquifers from the scope of the UN Draft Aquifer Articles, an aquifer body lying in one state whose recharge area is in another state would also fall outside the UNILC's work on shared waters.

With input from UNESCO, the Food and Agriculture Organization (FAO), the UNECE, and the International Association of Hydrogeologists (IAH)[889], Chusei Yamada attempted to educate the UNILC members by devoting a significant part of his first report to explaining the origins, dynamics and global significance of groundwater.[890] In his second report he eliminated the term 'confined' due to its technical imprecision[891] and then cited case studies of regionally important aquifers, such as the Nubian sandstone aquifer system, the Guarani aquifer

884 ibid 239
885 ibid 241
886 ibid 243
887 ibid 244
888 ibid 246
889 Yamada 2003 Report (n 879) para 26 Raya Stephan authored an article that provided a clear description of the process and procedure that accompanied adoption of the UN Draft Aquifer Articles. Raya M Stephan, 'The Draft Articles on the Law of Transboundary Aquifers: The Process at the UN ILC' (2011) 13 International Community Law Review 223
890 Yamada 2003 Report (n 879) paras 26-63
891 ILC, 'Second report on shared natural resources: transboundary groundwaters, by Mr Chusei Yamada, Special Rapporteur' (2004) UN Doc A/CN.4/539 and Add 1, para 13 (Yamada 2004 Report)

system, the Franco-Swiss Genevese aquifer and aquifers along the US-Mexico border[892].

From the beginning of the project, Chusei Yamada received expressions of concern from both the UNILC and the UN Sixth Committee about the use of the term 'shared' in the context of groundwaters, lest these waters be viewed as 'shared heritage of mankind' or become subject to shared ownership.[893] In order to avoid controversy, the Special Rapporteur elected to use the term 'transboundary' when referring to the groundwaters being studied, in lieu of the controversial term 'shared'.[894] States also emphasized that ownership of groundwater must be protected 'along the lines of oil and gas which had been recognized to be subject to sovereignty'.[895] Given the growing and vital importance of groundwater, it is not surprising that states rejected the notion of sharing the resource and that they also insisted on protecting their interests by employing arguments based on ownership and sovereignty. Using oil and gas law as support for claims of sovereignty is also not surprising since that body of law was protected by the powerful commercial and political forces that relied on the energy and economic power provided by hydrocarbons.

The relationship between the work on transboundary aquifers and the principles embodied in the UN Watercourses Convention[896] presented dilemmas for the UNILC. Yamada's assertion that almost all of the principles in the UN Watercourses Convention would apply to transboundary aquifers

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[892] ibid Annex IV
[893] ibid paras 2,3
[894] ILC, 'Report of the International Law Commission on the work of its fifty-sixth session' (3 May-4 June and 5 July-6 August 2004) UN Doc A/59/10, para 83
[895] ibid para 115
[896] In a 2011 article, Owen McIntyre compares the 'markedly different approach[es] to the utilization and environmental protection of transboundary water resources' taken by the UN Watercourses Convention and the UN Draft Aquifer Articles. Owen McIntyre, 'International Water Resources Law and the International Law Commission Draft Articles on Transboundary Aquifers: A Missed Opportunity for Cross-Fertilisation?' (2011) 13 International Community Law Review 237, 238-9 (McIntyre 2011). See also, Francesco Sindico and Laura Movilla, 'The Interplay between the UN Watercourses Convention and the Law on Transboundary Aquifers (Article 2)' in Laurence Boisson de Chazournes, Makane Moïse Mbengue, Mara Tignino, Komlan Sangbana (eds), *The United Nations Convention on the Law of the Non-Navigational Uses of International Watercourses. A Commentary* (Oxford University Press 2018).

engendered criticism within the UNILC and the UN Sixth Committee.[897] In particular, application of the two main principles– equitable and reasonable use and no significant harm – to transboundary aquifers could require additional scrutiny to ensure proper alignment with the intended goals. For example, what might be equitable use of renewable surface waters might not be equitable or reasonable when applied to finite, nonrenewable groundwater.[898] Similarly, given their enhanced susceptibility to permanent damage from pollution, aquifers may require a higher standard of protection from significant harm.[899] Because of uncertainty about application of the two main principles, the seven draft articles presented to the UNILC in 2004[900] left a blank placeholder in Article 3 for 'Principles governing aquifer systems'; Article 3 would later describe equitable and reasonable use of aquifers. Draft Article 4, 'Obligation not to cause harm', tracked the UN Watercourses Convention in advising states to "take all appropriate measures to prevent the causing of significant harm to other aquifer system States'[901]. Draft Article 4 additionally proposed aquifer-specific limitations on state activities by requiring states to take 'all appropriate measures' to avoid 'causing significant harm' to another state's aquifer system through activities that have an impact on their own domestic aquifer systems.[902] The article then goes further by protecting dependent ecosystems and the aquifer itself, requiring that states 'shall not impair the natural functioning of transboundary aquifer systems'.[903] Familiar principles such as a general obligation to cooperate[904] and a requirement to exchange data[905] also appeared in the first UNILC draft of the articles governing transboundary aquifers.

By the time that Chusei Yamada delivered his third report in 2005, the doctrine of permanent sovereignty over natural resources (PSNR) had been advocated

[897] Yamada 2004 Report (n 891) para 7
[898] ibid para 7
[899] ibid
[900] ibid Annex I
[901] ibid draft art 4(1)
[902] ibid draft art 4(2)
[903] ibid draft art 4(3)
[904] ibid draft art 5
[905] ibid draft art 6

strongly enough by its supporters that he agreed to reference it in the preamble to the draft articles.[906] Further, in introducing draft Article 5 on equitable and reasonable utilization, he stated that states 'have sovereign rights over the natural resources located within their jurisdiction', while allowing that 'such rights should not be absolute and unlimited.'[907] Yamada went on to explain that the right to equitable utilization related to rights of other aquifer states, and that the right to reasonable utilization related to the aquifer itself.[908] The Helsinki Rules list of factors to consider in an analysis of what is equitable and reasonable made an appearance in draft Article 6[909], and the list included in the draft articles copied 'almost word for word' the UN Watercourses Convention.[910]

The draft article obliging states not to cause significant harm was retained. Yet, while Chusei Yamada claimed that the substance 'remained unchanged' except for 'some editorial changes'[911], the provision prohibiting impairment of an aquifer's natural functioning was replaced by a paragraph directing states to 'take all appropriate measures, having due regard for the provisions of articles 5 and 6,' to eliminate or mitigate significant harm and, 'where appropriate, to discuss the question of compensation'.[912] Once again, the legacy of *Trail Smelter* continued to influence legal instruments produced by the UNILC, as protection of a natural system ceded to permission to cause transboundary harm subject only to an obligation to discuss compensation 'where appropriate'. Requests to lower the threshold from significant harm to one that protected the aquifer more carefully were rejected.[913] However, obligations to protect ecosystems and both recharge and discharge zones and to prevent, reduce and control

[906] ILC, 'Third report on shared natural resources: transboundary groundwaters, by Mr Chusei Yamada, Special Rapporteur' (2005) UN Doc A/CN.4/551 and Add 1, para 4
[907] ibid para 19
[908] ibid
[909] ibid para 23
[910] ibid para 24
[911] ibid para 25
[912] ibid draft art 7. As in the UN Watercourses Convention, Articles 5 and 6 describe equitable and reasonable utilization.
[913] ibid para 26

pollution were added.[914] The 2005 draft also included an article requiring states to 'agree on harmonized standards and methodology for monitoring a transboundary aquifer or aquifer system'[915] as well as an article requiring notification of planned measures that 'may have a significant adverse effect upon other aquifer States'[916]. In a provision that would later play a role in the controversy over the draft articles, an aquifer was defined as both the geological formation 'and the water contained in the saturated zone of the formation'.[917] At this point, the draft articles were still expected to constitute parts of a future convention to be signed and ratified by states,[918] although some members of the UNILC, citing the paucity of state practice regarding transboundary aquifers, argued that the final product should be a set of non-binding guidelines instead of a binding convention[919].

In 2006 the UNILC completed its first reading of the articles on the law of transboundary aquifers[920], and one article added to that draft provoked a heated controversy over sovereignty that still rages. Draft Article 3 bolstered claims of sovereignty over groundwaters:

> Each aquifer State has sovereignty over the portion of a transboundary aquifer or aquifer system located within its territory. It shall exercise its sovereignty in accordance with international law and the present draft articles.

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[914] ibid para 32, draft arts 12, 13 and 14
[915] ibid para 29, draft art 10
[916] ibid para 36, draft art 17
[917] ibid para 7, draft art 2(a)
[918] ibid para 2
[919] ILC, 'Report of the International Law Commission on the work of its fifty-seventh session' (2 May–3 June and 11 July–5 August 2005) UN Doc A/60/10, para 98. Yamada countered that there had been 'an upsurge in practice of States' regarding transboundary aquifer governance and urged the UNILC to continue its work 'in the progressive development and codification of the law on groundwaters . . . . in order to keep apace with a rapidly developing field.' ibid para 99
[920] ILC, 'Report of the International Law Commission on the work of its fifty-eighth session' (1 May-9 June and 3 July-11 August 2006) UN Doc A/61/10, para 26

Since the UNILC had already approved a definition of aquifer that included both the geological formation and the water therein, granting sovereignty over the aquifer through draft Article 3 meant that states would have sovereignty over both the geological formation and water found in the porous rocks. The definition of aquifer and the language of draft Article 3 remained unchanged through finalization of the draft articles, thus providing grist for debates over the extent and validity of sovereign claims over groundwater resources.

In 2008 the UNILC adopted the draft articles on the law of transboundary aquifers[921] as well as the commentary[922] and submitted them to the UNGA[923] with a recommendation that the UNGA take note of the draft articles and recommend that states enter into bilateral and multilateral agreements based on the draft articles. A decision on whether the draft articles should be expanded into a full convention was postponed until a later date.[924] The UNGA followed the recommendation of the UNILC and, similar to the process adopted for the UNEP Draft Principles, took note of the draft articles and annexed them to a resolution without a vote.[925] Eight years after the UNILC began its study of shared natural resources, the UN Draft Articles on the Law of Transboundary Aquifers (UN Draft Aquifer Articles) were formally approved by the General Assembly. [926]

The UNGA subsequently adopted three additional resolutions recommending the UN Draft Aquifer Articles to its members in 2011, 2013 and 2016[927], and the item was placed on the UNGA's provisional agenda for the seventy-fourth session in 2019[928]. While the initial resolutions recommended that states 'take

[921] ILC, 'Report of the International Law Commission on the work of its sixtieth session' (5 May–6 June and 7 July–8 August 2008) UN Doc A/63/10, para 46
[922] ibid para 47
[923] ibid para 48
[924] ibid para 49
[925] UNGA Res 63/124 (11 December 2008)
[926] ILC, 'Draft Articles on the Law of Transboundary Aquifers' (2008) UN Doc A/CN.4/L.724 (UN Draft Aquifer Articles)
[927] UNGA Res 66/104 (9 December 2011), UNGA Res 68/118 (16 December 2013) and UNGA Res 71/150 (13 December 2016)
[928] UNGA Res 71/150 (13 December 2016) para 3

into account' the UN Draft Aquifer Articles when entering into discussions, beginning in 2013 states were advised to use the articles 'as guidance'. Gabriel Eckstein and Francesco Sindico view this change as a significant step toward 'both a stronger recognition of the Draft Articles by the international community and a more assertive admonition to States to abide by the norms contained therein.'[929]

As stated earlier, the emphasis placed on sovereignty by UN Draft Aquifer Articles has proven to be controversial. In fact, Owen McIntyre called it 'without doubt the single most controversial departure from established international water resources law', since assertion of sovereignty over an international water resource is 'inconsistent with the entire historical and conceptual development of the principle of equitable and reasonable utilization'.[930] Kerstin Mechlam viewed the approach 'atypical for a legal instrument on transboundary freshwater resources' and suggested that it reflected the discredited Harmon Doctrine.[931] In a lengthy and scathing rebuke, Steven McCaffrey also linked the grant of sovereignty over both the geological formation and the water therein to the Harmon Doctrine's absolute territorial sovereignty and cited the *Restatement of Torts, River Oder* and *Gablikovo-Nagymaros Project* case for support of the notion of a community of interest in international waters.[932] Gabriel Eckstein has suggested that subjecting the grant of sovereignty to international law places limits on state actions.[933] Even though the UN Draft Aquifer Articles are not binding and face a long, rocky road to full acceptance[934],

[929] Gabriel Eckstein and Francesco Sindico, 'The Law of Transboundary Aquifers: Many Ways of Going Forward, but Only One Way of Standing Still' (2014) 23 Review of European Community and International Environmental Law 32, 34-5
[930] McIntyre 2011 (n 896) 249
[931] Kerstin Mechlam, 'Past, Present and Future of the International Law of Transboundary Aquifers' (2011) 13 International Community Law Review 209, 219
[932] McCaffrey 2009 (n 549) 286-292
[933] Gabriel E Eckstein, 'Commentary on the U.N. International Law Commission's Draft Articles on the Law of Transboundary Aquifers' (2007) 18 Colorado Journal of International Environmental Law & Policy 537, 561; Gabriel E. Eckstein, 'Managing buried treasure across frontiers: the international Law of Transboundary Aquifers' (2011) 36 Water International 573, 581
[934] For a discussion of the possible future of the UN Draft Aquifer Articles, see Eckstein and Sindico (n 929).

Laurence Boisson de Chazournes sees great value in the combined effect of the UN Watercourses Convention and the UN Draft Aquifer Articles, since together they promote and codify key principles such as equitable utilization, no significant harm and transboundary cooperation.[935]

3.4.3 UNECE guidance on groundwater governance

Stephen Schwebel, Stephen McCaffrey and Robert Rosenstock eventually succeeded in forcing the UNILC to devote time and energy to groundwater governance, but the three Special Rapporteurs of the UN Watercourses Convention were not alone in their desire to provide guidance on groundwater. The UNECE non-binding Charter on Groundwater Management[936], whose negotiation was launched in 1983 at the Seminar on Groundwater Protection Strategies and Practices in Athens[937], was issued in 1989. The charter consisted of a set of twenty-five articles containing detailed, clear and concrete measures that were designed to ensure adequate quantities and quality of groundwater. Similar to the Bellagio Draft Treaty that was published in the same year, this document assigned responsibility for implementation to states but was much more specific in reciting the actions to be taken by states in their domestic arenas, including directions on laws and policies. After declaring an overall goal that 'ground-water strategies should aim at the sustainable use of ground water and preservation of its quality'[938], the Charter on Groundwater Management lists '[p]rotection measures aimed at prevention of ground-water pollution and over-use':

> monitoring of ground waters, development of aquifer vulnerability maps, regulations for industry and waste disposal sites paying due account to ground-water protection considerations, geo-ecological assessment of

[935] Boisson de Chazournes (n 569) 38-39
[936] UNECE Charter on Groundwater Management (n 828)
[937] ibid Foreword
[938] ibid art II(1)

> the impact of industrial and agricultural activities on ground waters, and zoning of ground-water protection areas. [939]

Subsequent articles give guidance on groundwater allocation[940], permitting[941], impact assessments[942], land use planning[943], and pollution from agriculture[944], urban and industrial activities[945] and mining[946]. Due to the vital role played by groundwater, the Charter on Groundwater Management proposed that the resource 'should be declared in the public domain or authority should be vested in Government to restrict, in the public interest, the rights accruing from its private ownership'.[947] Although nearly all of the provisions address measures to protect domestic groundwater resources, the final article addresses transboundary groundwater and suggested that

> [c]oncerted endeavours to strengthen international co-operation for harmonious development, equitable use and joint conservation of ground-water resources located beneath national boundaries should be intensified.[948]

Like the Bellagio Draft Treaty, the Charter on Groundwater Management promoted establishment of joint commissions to effectuate transboundary cooperation[949], and it also supported accepted procedural principles for shared natural resources such as data sharing, monitoring and notification of planned measures, while also proposing additional joint activities such as 'establishment of adjacent protection zones [and] establishment of commonly agreed land-use

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[939] ibid art II(3)
[940] ibid art IV
[941] ibid arts VIII-XI
[942] ibid art XIV
[943] ibid art XVII
[944] ibid art XIX
[945] ibid art XX
[946] ibid art XXI
[947] ibid art V(3)
[948] ibid art XXV(1)
[949] ibid

plans and practices'[950]. Clearly, the 1989 UNECE charter fully embraced the philosophy of a community of interests and attempted to persuade constituent states to take concrete steps to protect domestic groundwater supplies and develop a system for sharing common groundwater resources.

Twenty years after adoption of the UNECE Water Convention, the UNECE adopted the Model Provisions on Transboundary Groundwaters[951] in 2012, which, like the previous guidelines on groundwater governance issued by the UNECE and other organizations, were once again non-binding. This most recent effort was led by Attila Tanzi and Alexandros Kolliopoulos and drew on prior water governance guidelines such as the UN Watercourses Convention, the UN Draft Aquifer Articles, the UNECE Charter on Groundwater Management, the UNECE Water Convention, the Seoul Rules, the Berlin Rules, the Bellagio Draft Treaty, the European Union Water Framework Directive, and the European Union Directive on the protection of groundwater against pollution and deterioration and several bilateral and multilateral treaties for specific aquifers and rivers. Intended as a tool for implementing the UNECE Water Convention where transboundary groundwaters are present[952], the nine model provisions logically mirror the UNECE Water Convention in placing a priority on prevention of transboundary harm.

Thus, Model Provision 1 begins with a mandate to 'take all appropriate measures to prevent, control and reduce any transboundary impact' and continues with a caution to 'use transboundary groundwaters in an equitable and reasonable manner'.[953] The model provisions attempt to ensure sustainable use 'with a view to maximizing the long-term benefits'[954] and direct parties to 'cooperate in the common identification, delineation and characterization of their transboundary groundwaters' and to 'establish programmes for the joint

[950] ibid art XXV(2)
[951] Model Provisions on Transboundary Groundwaters (2014) ECE/MP.WAT/40 (Model Provisions). The Model Provisions were adopted in 2012 but published in 2014.
[952] ibid v
[953] ibid 5 Model Provision 1
[954] ibid 6 Model Provision 2

monitoring and assessment of quantity and quality of transboundary groundwaters'[955]. Integrated management of surface and groundwater is required[956], and prevention, control and reduction of transboundary groundwater pollution is directed through protection zones, pollutant control, land use regulation and adoption of water quality criteria[957]. Data exchange[958], joint planning[959], environmental impact assessments[960] and joint bodies[961] are also featured. In a very real sense, the UNECE Model Provisions on Transboundary Groundwaters distilled the salient customary principles that had evolved for transboundary groundwater through the several non-binding instruments produced at the time. In spite of the fact that the no-harm principle is listed before the equitable and reasonable use principle, the commentary to Model Provision 1 diplomatically declares that the two principles are 'closely intertwined and neither enjoys priority over the other'[962].

In reviewing the guidance provided by scholars, the UNILC and the UNECE regarding transboundary aquifers, the same tensions that have accompanied discussions on transboundary surface water become evident. The Bellagio Treaty strongly favored collaboration and protection of the resource, the UNILC emphasized sovereignty over both the aquifer and the water, and the UNECE attempted to balance sovereign rights to utilization with limitations on sovereign actions that might do harm to the resource. As the next section will show, the fully-ratified treaties addressing transboundary aquifers avoided the tensions by minimizing their mutual obligations.

3.4.4 Treaties on transboundary aquifers

To date, only four treaties exclusively addressing transboundary aquifers are fully in force, and another three have been drafted and await entry into force.

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[955] ibid 8 Model Provision 3
[956] ibid 9 Model Provision 4
[957] ibid 9-10 Model Provision 5
[958] ibid 12 Model Provision 6
[959] ibid 12 Model Provision 7
[960] ibid 13 Model Provision 8
[961] ibid 14 Model Provision 9
[962] ibid 5 Commentary to Provision 1 para 3

The scope of the in-force treaties varies considerably from the draft treaties, leading to questions about whether customary law principles can yet be declared with respect to the subterranean freshwater resource.

The first treaty regarding a transboundary aquifer to be negotiated and finalized was a 1977 agreement between political subdivisions in France and Switzerland regarding artificial recharge of an aquifer on Swiss territory along Lake Geneva (also called Lac Léman) and extraction of its waters by France.[963] In 2008, at the end of the treaty's thirty-year term, a replacement agreement came into effect between the Community of the Annemassienne region, the Community of the Genevois Rural Districts, and the Rural District of Viry on the French side and the Republic and Canton of Geneva on the Swiss side.[964] Except for an additional obligation to produce and share data[965], the provisions of the new agreement are nearly identical to those of the 1977 agreement. The agreement allows the French parties to withdraw up to five million cubic meters of water annually[966] in exchange for participation in the costs of acquiring and maintaining the equipment necessary for artificial recharge of the aquifer.[967] The agreement also establishes a joint management commission[968] whose obligations include proposing a utilization program for groundwater withdrawals[969], keeping an inventory of relevant equipment[970], providing a technical opinion on new waterworks[971], and monitoring the quality of water that is extracted from the aquifer and water that is injected into the geological structure[972].

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[963] Arrangement relatif à la Protection, à l'Utilization et à la Réalimentation de la Nappe souterraine franco-suisse du Genevois (entered into force 9 June 1978)
[964] Convention relative à protection, à l'utilisation, à la réalimentation et au suivi de la nappe souterraine Franco-Suisse du Genevois (entered into force 1 January 2008) (2008 Franco-Genevese Treaty)
[965] ibid art 10
[966] ibid art 8
[967] ibid arts 11-14
[968] ibid art 1
[969] ibid art 2
[970] ibid art 4
[971] ibid art 5
[972] ibid art 16

As Gabriel de los Cobos has chronicled[973], the Franco-Genevese agreement is unique for treating the aquifer as a truly communal resource whose benefits and costs are shared by the parties under negotiated terms that have survived decades. However, the arrangement represents more of a business transaction than an agreement to manage finite groundwater. For treaties that embody the first timid steps toward management of finite groundwater resources, one must look to Northern Africa, where treaties were finalized and remain in force regarding two non-recharging fossil aquifers[974] – the Nubian Sandstone Aquifer System (NSAS) and the Northwest Sahara Aquifer System (NWSAS).

The aquifer underlying Chad, Libya, Egypt and Sudan that constitutes the NSAS spans an area exceeding two million square kilometers[975] and has been a source of water in an arid area since 1960, with withdrawals increasing significantly since 2000[976]. In 1992, Egypt and Libya established a Joint Authority that was given a number of responsibilities including collection of all information and data developed by the member States, preparation of any other studies necessary to have a full understanding of the quality and quantity of the water in the NSAS, and development of programs for resource utilization and 'rational consumption' by member States.[977] Sudan joined in 1996, and Chad followed in 1999.[978] As its name indicates, the treaty's sole purpose was to establish a Joint Authority, which was to have corporate status[979] with an executive director[980]

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[973] Gabriel de los Cobos, *L'Eau Sans Frontière: Quarante Ans d'Une Gestion Partagée de la Nappe d'Eua Souterraine du Genevois* (Éditions Slatkine 2012); Gabriel de los Cobos, 'The Genevese transboundary aquifer (Switzerland-France): The secret of 40 years of successful management' (2018) 20 Journal of Hydrology: Regional Studies 116

[974] Gabriel Eckstein defines a fossil aquifer as 'an aquifer (confined or unconfined) containing water that was buried at the same time as the geologic formation in which it is trapped'. Gabriel Eckstein, 'A Hydrogeological Perspective of the Status of Ground Water Resources Under the UN Watercourse Convention' (2005) 30 Columbia Journal of Environmental Law 525, 545 fn 94

[975] Ahmed M Yosri, Mohamed A Abd-Elmegeed and Ahmed E Hassan, 'Assessing groundwater storage changes in the Nubian aquifer using GRACE data' (2016) 9 Arabian Journal of Geosciences 566, 567

[976] ibid 570

[977] Constitution of the Joint Authority for the Study and Development of the Nubian Sandstone Aquifer Waters (1992) (NSAS Agreement)

[978] Laura Movilla Pateiro, 'Ad hoc legal mechanisms governing transboundary aquifers: current status and future prospects' (2016) 41 Water International 851, 853

[979] NSAS Agreement (n 977) art 24

[980] ibid art 13

and a board of directors[981], with expenses shared equally among the parties[982]. The four states executed two further agreements in 2000 to facilitate monitoring and data exchange: the Terms of Reference for the Monitoring and Exchange of Groundwater Information of the Nubian Sandstone Aquifer System, and the Terms of Reference for Monitoring and Data Sharing.[983] While the agreements create a joint body and contemplate sharing of data, effective monitoring systems have been difficult to achieve due to the associated high costs and the difficulty in extrapolating regional information from field measurements.[984]

The NWSAS consists of two minimally recharging aquifers that extend for one million square kilometers under Libya, Algeria and Tunisia.[985] The aquifer has benefitted from a multi-phase programme that includes a 2002 agreement among the aquifer states to create a consultation mechanism in order 'to coordinate, promote and facilitate the rational management of the NWSAS water resources.'[986] The regional Observatory of the Sahara and Sahel[987] serves as the administrator of the NWSAS consultative mechanism, which was designed to develop, gather, analyze and update data on the aquifer.[988] Now in its third phase, the tri-partite project has a goal of gathering and sharing information about the aquifer system and making recommendations for its

[981] ibid art 5
[982] ibid art 16
[983] Programme for the Development of a Regional Strategy for the Utilisation of the Nubian Sandstone Aquifer System (NSAS) –Terms of Reference for the Monitoring and Exchange of Groundwater Information of the Nubian Sandstone Aquifer System Agreement No 1 - Terms of Reference for the Monitoring and Exchange of Groundwater Information of the Nubian Sandstone Aquifer System Agreement No 2 - Terms of Reference for Monitoring and Data Sharing, (Tripoli, 5 October 2000)
[984] Yosri, Abd-Elmegeed and Hassan (n 975) 566
[985] 'Projet « Système Aquifère du Sahara Septentrional » - SASS' (*Observatoire du Sahara et du Sahel)* <http://www.oss-online.org/fr/projet-«-système-aquifère-du-sahara-septentrional-»-sass> accessed 28 January 2018
[986] Establishment of a Consultation Mechanism for the Northwestern Sahara Aquifer System (2002) (NWSAS Treaty) art i
[987] ibid art iii
[988] ibid art iv

sustainable use.[989] As with the NSAS treaty, the agreement for the NWSAS has a limited scope and does not impose any limitations on sovereignty.

The fourth and most recent treaty to focus exclusively on a transboundary aquifer was signed in 2015 by Saudi Arabia and Jordan to manage and protect part of the shared Al-Sag/Al-Disi Aquifer.[990] This aquifer also receives minimal recharge but has been heavily exploited since its discovery in the late 1970s.[991] The treaty goes further than the agreements for the NSAS and the NWSAS by taking concrete steps to protect the aquifer through establishment of a Protected Area and prohibition of extraction activities in the Protected Area for a period of five years.[992] The treaty also creates a Management Area that is larger than the Protected Area that will be protected from pollution[993] and where the extracted water will be used only for municipal (not agricultural) purposes.[994] As with the other agreements for transboundary aquifers, the Al-Sag/Al-Disi agreement creates a joint body, in this case known as the Joint Saudi/Jordanian Technical Committee[995], that is headed by high level ministers in charge of water in each state and whose responsibilities include 'supervision and observation of the groundwaters, from the point of view of the quantity of water extracted, its quality and level'[996] and 'collection and exchange of information, statements and studies and their analysis' and submission of the collected information to the states[997]. Once again, words supporting the standard principles of customary practices such as equitable and sustainable

[989] 'Phase III of the SASS project (North-western Sahara Aquifer System)' (*Observatoire du Sahara et du Sahel)* <http://www.oss-online.org/en/phase-iii-sass-project-north-western-sahara-aquifer-system> accessed 28 January 2018
[990] Agreement between the Government of the Hashemite Kingdom of Jordan and the Government of the Kingdom of Saudi Arabia for the Management and Utilization of the Ground Waters in the Al-Sag/Al-Disi Layer (entered into force 30 April 2015) (Al-Sag/Al-Disi Treaty)
[991] Gabriel Eckstein, 'The Newest Transboundary Aquifer Agreement: Jordan and Saudi Arabia Cooperate Over the Al-Sag /Al-Disi Aquifer' (*International Water Law Project Blog,* 31 August 2015) <http://www.internationalwaterlaw.org/blog/2015/08/31/the-newest-transboundary-aquifer-agreement-jordan-and-saudi-arabia-cooperate-over-the-al-sag-al-disi-aquifer/> accessed 28 January 2018
[992] Al-Sag/Al-Disi Treaty (n 990) art 2
[993] ibid art 2(5)
[994] ibid art 2(6)
[995] ibid art 3(1)
[996] ibid art 3(4)(b)
[997] ibid art 3(4)(c)

use and no significant harm do not appear. However, by limiting extractions and preventing pollution in a Management Area, the treaty arguably embodies the standard substantive principles of international water law, and the obligations to monitor and exchange data reflect the procedural principles as well.

In addition to the four aquifer-specific agreements noted above, three others have been drafted and negotiated but are not yet in force. The earliest is a 2009 draft memorandum of understanding among Mali, Niger and Nigeria regarding the Illumeden aquifer system, which consists of two main aquifers – the lower Continental Intercalaire and the upper Continental Terminal (Illumeden MOU).[998] The Illumeden MOU followed a five-year project that was funded by the UN Global Environment Facility and once again involved the Observatory of the Sahara and Sahel as the implementing agency.[999] With a goal to 'strengthen solidarity and promote cooperation . . . in order to facilitate the joint identification of risks'[1000] and 'facilitate joint management of these risks'[1001], the Illumeden MOU created a joint body in the form of a consultative mechanism with broad authority[1002] and full legal status[1003]. The provisions of the Illumeden MOU support 'consideration [of] the principles' of equitable and reasonable use[1004], public participation[1005], non-detrimental use[1006], precautionary measures[1007], polluter-pays[1008], and user-pays[1009]. Data-sharing[1010], prior notification of any activity that could adversely affect the

[998] Memorandum of Understanding Relating to the Setting Up of a Consultative Mechanism for the Management of the Iullemeden Aquifer System (dated 20 June 2009; not yet in force) (Iullemeden MOU)
[999] Movilla Pateiro (n 978) 854
[1000] Iullemeden MOU (n 998) art 3(b)
[1001] ibid art 3(c)
[1002] ibid art 5
[1003] ibid art 6
[1004] ibid art 13
[1005] ibid art 14
[1006] ibid art 15
[1007] ibid art 16
[1008] ibid art 17
[1009] ibid art 18
[1010] ibid art 19(a)

aquifer[1011], environmental protection of ecosystems and conservation of the aquifer resources[1012] were also included. Although the Illumeden MOU went much further than the in-force treaties in clearly providing for the limitations on sovereignty that appear in the global treaties, the Illumeden MOU has not entered into force and thus its legal value is questionable.

After a hydraulic link was verified between the Illumeden Aquifer system and the nearby Taoudeni/Tanezrouft Aquifer System, the parties to the Illumeden MOU negotiated a second memorandum of understanding with Algeria, Benin, Burkina-Faso and Mauritania that was completed in 2014 (ITAS MOU).[1013] The combined aquifer system extends over two and half million square kilometers and was given the acronym ITAS.[1014] The ITAS MOU closely resembles the Illumeden MOU, but its provisions also introduce emerging principles such as a general duty to cooperate[1015], complementarity[1016], sustainable development[1017], partnership[1018], and joint planning[1019]. The ITAS MOU, like the Illumeden MOU, has not yet entered into force, so its contribution to the body of customary water law principles is doubtful. However, in spite of the fact that neither MOU has come into force, the aquifer states for both the Illumeden Aquifer System and the ITAS are cooperating through the Observatory of the Sahara and Sahel to develop joint monitoring programs and to achieve joint, integrated management for both surface water and groundwater resources.[1020] While the current joint activities may be limited to gathering information regarding the aquifer systems, the very fact that the parties are taking proactive steps toward joint management under the auspices of the Observatory of the

[1011] ibid art 20, 22-28
[1012] ibid art 21
[1013] Memorandum Of Understanding for the Establishment of a Consultation Mechanism for the Integrated Management of the Water Resources of the Iullemeden, Taoudeni/Tanezrouft Aquifer Systems (dated 28 March 2014; not yet in force) (ITAS MOU)
[1014] 'GICRESAIT Project' (*Sahara and Sahel Observatory*) <http://www.oss-online.org/en/gicresait-project> accessed 28 January 2018
[1015] ITAS MOU (n 1013) art 14
[1016] ibid 15
[1017] ibid art 16
[1018] ibid art 17
[1019] ibid art 21
[1020] GICRESAIT Project (n 1014)

Sahara and Sahel is an indication that aquifer states may be taking timid steps toward accepting a community of interests in water resources in order to maximize the ultimate benefits that can be gained from both surface and groundwater.

The treaties and MOUs described above concern aquifers in Africa or the Middle East. However, a large aquifer in Latin America has also been the topic of an agreement that, like the Illumeden MOU and ITAS MOU, has not yet entered into force. The 2010 Guarani Aquifer, covering 1.2 million square kilometers, lies under Brazil, Argentina, Paraguay and Uruguay and is estimated to contain enough water to meet the needs of Brazil for 3500 years.[1021] Beginning in 2003 and ending in 2009, the UN Global Environment Facility, the four aquifer states and the Organization of American States collaborated[1022] to produce a programme to facilitate 'expansion and consolidation of the current knowledge base, creation of collaborative management framework, information for public participation, and monitoring and evaluation', as well as pollution prevention.[1023] At the end of the project the states reached agreement on a treaty[1024] that was signed by all four governments, but, as of December 2018, the treaty had not entered into force since Paraguay had not yet deposited its instrument of ratification with the repository state Brazil[1025]

[1021] 'Environmental Protection and Sustainable Integrated Management of the Guarani Aquifer' (*Global Environment Facility*) https://www.thegef.org/project/environmental-protection-and-sustainable-integrated-management-guarani-aquifer accessed 3 August 2017

[1022] For a description of the process that culminated in the Guarani Aquifer Agreement, see Francesco Sindico, 'The Guarani Aquifer System and the International Law of Transboundary Aquifers' (2011) 13 International Community Law Review 255, and Francesco Sindico, Ricardo Hirata and Alberto Manganelli, 'The Guarani Aquifer System: From a Beacon of hope to a question mark in the governance of transboundary aquifers' (2018) 20 Journal of Hydrology: Regional Studies 49

[1023] ibid

[1024] Guarani Aquifer Agreement (dated 2 August 2010; not yet in force)

[1025] Pilar Carolina Villar, 'Countdown to the Guarani Aquifer Agreement coming into force: will it be effective in promoting transboundary groundwater governance?' (*International Water Law Project Blog*, 18 June 2018) https://www.internationalwaterlaw.org/blog/2018/06/18/countdown-to-the-guarani-aquifer-agreement-coming-into-force-will-it-be-effective-in-promoting-transboundary-groundwater-governance/ accessed 20 August 2018

The Guarani Aquifer Agreement once again raised the spectre of sovereignty over groundwater, for the states declared that they are the 'sole owners' of the resource[1026] and provided that '[e]ach Party exercises sovereign territorial control over their respective portions of the Guarani Aquifer System' limited only by 'their constitutional and legal arrangements' and 'norms of applicable international law'.[1027] Although each party is given 'the sovereign right to promote the management, monitoring, and sustainable utilization of the . . . water resources', the agreement includes the familiar principles of reasonable and sustainable utilization[1028], no significant harm to the aquifer or the environment[1029], information exchange[1030], and prior notice of activities that may have an impact on the aquifer[1031]. A joint body in the form of a commission to coordinate cooperation and compliance under the Guarani Aquifer Agreement is contemplated by using the offices of the Treaty of the Plata River Basin, a treaty to which all of the Guarani Aquifer states are parties[1032]. The fealty shown in the Guarani Aquifer Agreement to the extension of sovereignty over an aquifer and its waters that is found in the UN Draft Aquifer Articles could be seen as a worrisome regression in international water law. However, Francesco Sindico argues that geo-political history compelled the states to assert sovereignty and that the limitations of constitutional arrangements and international law will prevent them from making wholesale declarations of absolute control over the groundwaters within their borders.[1033]

When reviewing the four fully-ratified treaties addressing transboundary aquifers that are currently in place, the principles of equitable and reasonable utilization and no significant harm are noticeably absent. However, states have accepted an obligation to cooperate and to monitor and share data, and all of the four treaties have mirrored the Bellagio Draft Treaty recommendation to form

[1026] Guarani Aquifer Agreement (n 1024) art 1
[1027] ibid art 2
[1028] ibid art 3
[1029] ibid
[1030] ibid art 8
[1031] ibid art 9-11
[1032] ibid art 15
[1033] Sindico (n 1022) 261

joint bodies. While the draft treaties for the Illumeden, the ITAS and the Guarani Aquifer may feature the surface water principles of equitable and reasonable utilization and no significant harm, the fact that these treaties have not yet entered into force calls into question whether the law of transboundary surface water is fully replicated in transboundary aquifer law.

3.5 Conclusion

In an effort to identify which legal principles governing the non-navigational use of land-based freshwater might influence governance of offshore freshwater, this chapter has traced the evolution of those principles. As resource-intensive economic development surged, the early theories of a community of interest in and protection of international waters ceded to the substantive principle of equitable and reasonable utilization, beginning with the Helsinki Rules and continuing with its legal progeny -- the UN Watercourses Convention and the UN Draft Aquifer Articles. The ICJ seemed to lend its support to the principle of equitable and reasonable utilization when its *Gabcíkovo-Nagymoros Project Case* ruling, which was issued in the same year that the UN Watercourses Convention was opened for signature, took note of equitable and reasonable utilization and did not mention the principle of no significant harm. However, the legal pendulum seems to be swinging back toward protection of natural resources. The UNECE has always supported the supremacy of the principle of no significant harm, and the ICJ indicated its preference for the no significant harm principle in the *Pulp Mills Case* and in its 2018 judgment in the dispute between Nicaragua and Costa Rica. While the debate ensues about the priority to be given to the substantive principles, all sides seem to agree on the procedural principles -- cooperation, data sharing and prior notice of planned measures. All of these principles reflect agreed limitations on exercises of sovereignty over an international watercourse.

The principles on governance of transboundary aquifers are not so clear-cut. Early attempts to adopt surface water principles in their entirety have not been

accepted, as evidenced by the relative lack of interest in the UN Draft Aquifer Articles and the inability of treaties containing those principles to achieve ratification. Of the more than six hundred transboundary aquifers in the world[1034], only four feature ratified agreements, and, except for the Franco-Genevese agreement, the ratified treaties provide for not much more than monitoring, data-sharing and joint commissions. A return to declarations of sovereignty over groundwater in the UN Draft Aquifer Articles and the Guarani Aquifer agreement could represent a worryingly regressive legal phenomenon that has not been replicated in surface water law. A defensible trend cannot be discerned from only four treaties and a handful of unratified agreements and non-binding guidelines, and it seems fair to say that the law on transboundary aquifers is unsettled and even embryonic.

With respect to the influence of land-based freshwater law on transboundary offshore freshwater resources, any predictions would be premature and speculative. Should states look to land-based water law for guidance in governing their shared offshore resources, procedural principles such as monitoring, data sharing and notice of planned measures can be expected to apply. The practice of establishing joint commissions for transboundary land-based aquifers can also be expected to be utilized for offshore freshwater aquifers, especially since, as will be described in Chapter 4, joint commissions are also utilized for offshore transboundary hydrocarbons. The real debates will arise over the substantive principles – community of interest, equitable and reasonable utilization and no significant harm. Considering that, due to the threat of seawater intrusion, offshore freshwater resources will doubtless be even more sensitive to spoliation than land-based aquifers, the no significant harm principle should take precedence over the principle of equitable and reasonable utilization. Assertions of sovereignty over the resource may cede to practical needs to cooperate in development of transboundary reserves. As will

[1034] 'IGRAC publishes new Transboundary Aquifers of the World Map' (*International Groundwater Resources Assessment Centre)* <https://www.un-igrac.org/news/igrac-publishes-new-transboundary-aquifers-world-map> accessed 28 January 2018

be explained in the next chapter on legal principles governing offshore hydrocarbon development, states can readily agree to effectuate a community of interests and limit exercises of sovereignty when cooperation renders tangible commercial benefits. Ironically, when seeking inspiration for equitable development of transboundary resources, the hydrocarbon industry took inspiration from the international water law principle of equitable and reasonable utilization and found a practical solution to protecting the resource by developing shared reservoirs as a single unit.

CHAPTER 4

LEGAL PRINCIPLES GOVERNING OFFSHORE HYDROCARBON DEVELOPMENT

INTRODUCTION

In an absence of clear precedent, this thesis has analyzed different bodies of law to determine which legal principles might be applicable in the event that states begin to utilize offshore freshwater resources. Chapter 2 explored the UN Convention on the Law of the Sea (LOSC)[1035] which clarified that states have sovereignty over natural resources within their territorial seas and sovereign interest in natural resources in the seabed of their two-hundred-mile Exclusive Economic Zones (EEZs) and in their extended outer continental shelves (OCS). Unfortunately, LOSC is unhelpfully silent regarding offshore transboundary natural resources, but the Permanent Court of International Justice (PCIJ) and the International Court of Justice (ICJ) have consistently supported a community of interests by insisting that states negotiate equitable solutions. Chapter 2 also determined that exercises of sovereign control are not absolute and that certain agreed limits on absolute sovereignty have developed.

Chapter 3 went on to examine the growing body of international law for land-based freshwater, which originally viewed navigable rivers as a common resource and protected open access to navigation on major rivers in support of trade. As non-navigational uses of freshwater, such as for hydropower and agriculture, began to increase in the twentieth century, global institutions issued guidance on governance of shared land-based freshwater resources. Several principles distilled from that process: equitable and reasonable utilization of the shared resource, no significant harm to a neighbor's rights or interests, cooperation, data sharing, environmental protection and prior notice of planned activities that would be likely to have a significant transboundary

[1035] United Nations Convention on the Law of the Sea (adopted 10 December 1982, entered into force 16 November 1994) 1833 U.N.T.S. 897 (LOSC)

impact. These principles were developed mainly for shared surface water, and their application to the hundreds of land-based transboundary aquifers remains unclear.

Chapter 3.4.2 described how the UN Draft Articles on the Law of Transboundary Aquifers[1036] (UN Draft Aquifer Articles) emanated from a UN International Law Commission (UNILC) study of shared natural resources. When adopting shared natural resources as part of its long-term programme of work, the UNILC placed oil, gas and groundwater in the same analytical basket due to their perceived similarities, but elected to proceed first with groundwater. Ultimately, the UNILC chose not to attempt to codify principles regarding ownership and utilization of transboundary hydrocarbon resources. In a paper submitted to the UNILC, Shinya Murase summarized the comments of forty-six states that responded to a UNILC survey on the topic, with the majority preferring that the project be abandoned for the following reasons:

> (a) the question of oil and gas is essentially different from that of groundwater; (b) the issue is closely intertwined with the bilateral interests of the States involved; (c) it cannot be separated from boundary delimitation; (d) it is not suitable for codification; and (e) it involves political sensitivity and technical difficulty.[1037]

All of these points are valid, yet one cannot dismiss the effect of the immense power of the hydrocarbon industry and the political and financial influence of nations with significant hydrocarbon reserves, none of whom may have wanted to be bound by rules, or even guidelines, produced by the UNILC that might limit their control over a valuable global commodity. Thus, while the UN was heavily involved in producing governance frameworks for both the oceans and

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[1036] 'Draft Articles on the Law of Transboundary Aquifers' (2008) UN Doc A/CN.4/L.724 (UN Draft Aquifer Articles)

[1037] ILC, 'Shared natural resources: feasibility of future work on oil and gas' (2010) UN Doc A/CN.4/621

international watercourses, governance of hydrocarbons has been left to bilateral agreements regarding specific transboundary areas.

Since technology for exploiting offshore freshwater aquifers would closely resemble that utilized for offshore hydrocarbon development and since offshore methane hydrates have been classified as hydrocarbons, Chapter 4 will describe established legal principles in the hydrocarbon industry that might influence development of offshore freshwater resources either by analogy or by direct application. States would clearly have the right to exert sovereign control over domestic natural resources such as those lying in the seabed of a state's territorial sea, its EEZ or its OCS, but the rules regarding shared offshore natural resources are murkier. The legal principles governing offshore hydrocarbons will almost certainly apply to methane hydrates, in spite of the fact that eighty-three percent of the formation consists of frozen freshwater.[1038] Whether those same precepts will also be viewed as being applicable to transboundary offshore aquifers can be debated, but analogies can certainly be drawn.

This chapter will begin with the hydrocarbon industry's approach to shared resources before discussing guidance from the ICJ regarding equitable apportionment of transboundary offshore natural resources. The chapter will then explore a representative sample of the bilateral treaties that govern transboundary offshore hydrocarbons, transboundary offshore natural resources, and transboundary offshore minerals. Transboundary offshore aquifers would fall within the scope of treaties addressing offshore natural resources, while all three types of treaties -- those addressing hydrocarbons, natural resources, and minerals -- would apply to the development of methane hydrates. Finally, since exploration and extraction of offshore freshwater will affect the marine environment through drilling and extraction, the chapter will close with an explanation of the environmental impacts of offshore hydrocarbon activities.

[1038] *Frozen Heat: A Global Outlook on Methane Gas Hydrates (Executive Summary)* (United Nations Environment Programme 2014) 8

4.1 Governance structures for hydrocarbon development

4.1.1 Early efforts

The United Nations International Law Commission (UNILC) began developing a legal regime for offshore natural resources as one of its earliest projects, resulting in the 1958 Convention on the Continental Shelf.[1039] A decade later in 1969, the International Court of Justice (ICJ) issued the first of the *North Sea Continental Shelf Cases* addressing offshore natural resources, cases that were brought principally to determine rights to hydrocarbons lying under the North Sea.[1040] The activities of the UNILC and the ICJ were prompted by both a desire to avoid future disputes and an attempt to resolve current disputes over development of offshore natural resources, especially hydrocarbons. While legal guidance congealed, proactive commercial and industrial interests began crafting solutions of their own.

In the same year that the Convention of the Continental Shelf was produced, Saudi Arabia and Bahrain signed the first treaty to address joint exploitation of offshore hydrocarbons, agreeing to share the resulting income.[1041] Two years later in 1960, Saudi Arabia and Kuwait jointly granted drilling concessions to the Arabian Oil Company, a consortium of sixty Japanese companies that had struck oil in the Khafji field of the Persian Gulf.[1042] These bilateral solutions produced without direct guidance from global organizations became ever more important and necessary as each pronouncement from the UN and the ICJ encouraged just such a negotiated approach to transboundary natural resource development.

[1039] Convention on the Continental Shelf (adopted 29 April 1958, entered into force 10 June 1964) 499 UNTS 311, TIAS No. 5578, 15 UST 471

[1040] *North Sea Continental Shelf Cases (Federal Republic of Germany/Denmark; Federal Republic of Germany/Netherlands)* (Merits) (1969) ICJ Rep 3 (*North Sea Continental Shelf Cases*)

[1041] William T Onorato, 'Apportionment of an International Common Petroleum Deposit' (1968) 17 International & Comparative Law Quarterly 85, 87 (Onorato 1968)

[1042] Fereidun Fesharaki, 'Joint Development Of Offshore Petroleum Resources: The Persian Gulf Experience?' (1981) 6 Energy 1325, 1329

Logically, in order for a resource to be transboundary, a boundary line must exist between two or more states. Determination of a marine boundary line, a process known as delimitation, takes the form of a treaty between the relevant states, and some delimitation treaties contain provisions regarding natural resources such as hydrocarbons and other minerals. An early example is the 1969 delimitation treaty between Indonesia and Malaysia, wherein the parties agree to cooperate on development of any transboundary oil or gas field that may be discovered:

> If any single geological petroleum or natural gas structure extends across the straight lines referred to in Article I and the part of such structure which is situated on one side of the said lines is exploitable, wholly or in part, from the other side of the said lines, the two [states] will seek to reach agreement as to the manner in which the structure shall be most effectively exploited.[1043]

On 28 January 1971, two years after the ICJ's decision in the *North Sea Continental Shelf Cases,* the three disputants, Germany, Denmark and the Netherlands, concluded two identical delimitation treaties for their shared portion of the North Sea, and those treaties contained provisions requiring the parties to coordinate resource development by adopting regulations should the presence of transboundary minerals be confirmed.[1044]

[1043] Agreement between the Government of the Republic of Indonesia and the Government of Malaysia relating to the delimitation of the continental shelves between the two Countries (adopted 27 October 1969, entered into force 7 November 1969) art 4. According to Ambassador Eddy Pratamo, Special Envoy of the President of the Republic of Indonesia for Maritime Delimitation between Indonesia and Malaysia, this treaty that delimited the continental shelf did not delimit the EEZ between the two countries, since LOSC came into effect after signature of the 1969 treaty. Eddy Pratamo, 'Indonesia–Malaysia maritime boundaries delimitation: a retrospective' (2016) 8 Australian Journal of Maritime and Ocean Affairs 73, 75

[1044] Treaty between the Kingdom of the Netherlands and the Federal Republic of Germany concerning the delimitation of the continental shelf under the North Sea (adopted 28 January 1971, entered into force 7 December 1972) 857 UNTS 130, art 2 (Netherlands-Germany North Sea Delimitation Treaty); Treaty between the Kingdom of Denmark and the Federal Republic of Germany concerning the delimitation of the continental shelf under the North Sea (adopted 28 January 1971, entered into force 7 December 1972) 857 UNTS 119, art 2

Governance of transboundary resources, where the hydrocarbon reserves straddle the maritime boundary of two or more states, is more complicated when marine boundaries have not yet been delimited. As demand for hydrocarbons increased and as drilling technology improved in the 1950s[1045] and 1960s[1046], states found ways to cooperate with one another where boundaries were disputed and/or where hydrocarbon deposits underlay areas over which more than one state could claim jurisdiction. As explained below, a fulsome body of treaties, contract law and customary practices developed over the course of the past half-century to guide and govern exploration and exploitation of transboundary offshore hydrocarbons, even when the boundaries are not agreed.

Cooperative development was not always the accepted practice. Since the United States was one of the early developers of petroleum reserves, its domestic owners of hydrocarbon rights produced the first approach to transboundary development – the rule of capture. Under the rule of capture, a party with rights to the subsurface mineral had to possess the resource in order to claim ownership, leading rights holders in the same reservoir to engage in an extraction race. Multiple wells would be drilled to tap and extract the hydrocarbons from a single resource pool, a practice that was inefficient, wasteful and conflictual.[1047] According to William Onorato in a 1968 article, the rule of capture was eventually replaced by 'the doctrine of co-relative rights and duties between owners in a common source', a doctrine by which each owner had obligations to avoid wasting the resource intentionally or through negligence, in order to prevent spoilage and to extract only a fair share of the resource.[1048] Onorato went on to note that in the domestic laws of most oil-producing states, co-relative rights and duties had evolved into a duty to co-operate under 'a unitized plan of development.'[1049] Judge Jessup in his separate

[1045] Barry Buzan, *Seabed Politics* (Praeger Publishers 1976) 35
[1046] ibid 60-61, 124-5
[1047] Onorato 1968 (n 1041) 89
[1048] ibid 91-92
[1049] ibid 92

opinion in the ICJ's *North Sea Continental Shelf Cases* cited Onorato's 1968 article in support of cooperative development of petroleum resources.[1050]

Onorato's article referred to international water law as an example of legally sanctioned cooperation in development and utilization of a common resource that has properties similar to petroleum – a valuable resource with fluid nature that does not respect political boundaries.[1051] Judge Jessup noted the 'numerous examples of cooperative use and of sharing of fluvial resources' in rendering his separate opinion about joint exploitation of shared resources.[1052] Likewise, Rainer Lagoni looked to the concept of reasonable and equitable use of the waters in a river drainage basin to support protecting the unity of a hydrocarbon deposit.[1053] Twenty years after Lagoni's article was published, David Ong argued in favor of protecting the unity of a deposit through unitization and joint development by citing the equitable apportionment principle of international water law that weighs the 'legitimate interests of states' in each particular set of circumstances to achieve an agreed outcome.[1054] International water law principles therefore exerted a profound influence during the genesis of international hydrocarbon law.

Onorato's and Jessup's pronouncements on the progressive evolution of a legal obligation to cooperate in development of a common resource were probably influenced not only by customary practices for shared water resources but also by a series of treaties signed in the 1960s by nations bordering the North Sea. In 1962 the Federal Republic of Germany and the Kingdom of the Netherlands

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[1050] *North Sea Continental Shelf Cases (Federal Republic of Germany/Denmark; Federal Republic of Germany/Netherlands)* (Separate Opinion of Judge Jessup) (1969) ICJ Rep 67, 83 (Jessup Opinion) Judge Jessup's opinion incorrectly attributes Onorato's 1968 article to 1958.
[1051] Onorato 1968 (n 1041) 93, 96. Water in confined, non-recharging aquifers has additional similarities to petroleum by being encased in closed geological formations that require effort and skill to access.
[1052] Jessup Opinion (n 1050) 82
[1053] Rainer Lagoni, 'Oil And Gas Deposits Across National Frontiers' (1979) 73 American Journal of International Law 215, 239-240
[1054] David M Ong, 'Joint Development of Common Offshore Oil and Gas Deposits: "Mere" State Practice or Customary International Law? (1999) 93 The American Journal of International Law 771, 780 (Ong 1999)

supplemented a 1960 treaty protecting access to the sea via the shared Ems Estuary[1055] by adopting an additional agreement whereby the parties confirmed that they and their concessionaires would cooperate on exploration and exploitation of natural resources in the Ems Estuary, particularly oil and gas.[1056] In 1965 and 1966, prior to the ICJ *North Sea Continental Shelf Cases* and prior to full delimitation of their maritime boundaries, the United Kingdom, the Netherlands, Denmark and Norway resolved their differences over exploitation of common oil and gas deposits in the North Sea by executing several bi-lateral agreements requiring the states to attempt to reach agreement about how to exploit the resource effectively and how to apportion the costs and profits.[1057]

These early ventures into cooperative development of a lucrative resource proved that a combination of practicality and economics could persuade states to look beyond their parochial sovereign concerns and maximize their returns through collaboration, reinforcing the presence and power of a community of interests. The balance of this section will describe concrete examples where nations have voluntarily limited their sovereign claims to natural resources in order to collaborate with neighboring states on efficient commercial development of natural resources. The resulting legal structures can all be seen as modern incarnations of the philosophy of the community of nations that governed navigational uses of shared watercourses for centuries.

4.1.2 Unitization Agreements

Shortly after the initial treaties that inaugurated cooperative development of hydrocarbons, the concept of developing a shared resource as a single unit,

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[1055] Treaty Between the Kingdom of the Netherlands and the Federal Republic of Germany Concerning Arrangements For Co- Operation In The Ems Estuary (adopted 8 August 1960, entered into force 1 August 1963) 509 UNTS 64 (Ems-Dollard Treaty)

[1056] Supplementary Agreement to the Treaty Between the Kingdom of the Netherlands and the Federal Republic of Germany Concerning Arrangements For Co- Operation In The Ems Estuary (adopted 14 May 1962, entered into force 1 August 1963) 509 UNTS 140 (Ems-Dollard Supplementary Agreement)

[1057] Onorato 1968 (n 1041) 88, fn 8. The 1971 bilateral treaty between Denmark and the Netherlands replaced the 1966 treaty between those states-parties. Protocol to the Treaties of 28 January 1971 between the Federal Republic of Germany and Denmark and the Kingdom of the Netherlands, respectively, concerning the delimitation of the continental shelf under the North Sea (adopted 28 January 1971, entered into force 21 February 1973)

known as 'unitization' was widely accepted into practice.[1058] With unitization, common owners of an identified oil or gas field combine their separate interests into a single unit for purposes of exploration and extraction (often by a single operator) and also for purposes of dividing both costs and revenues.[1059] In 1976, Norway and the United Kingdom signed a formal international unitization agreement to develop the Frigg gas field in the North Sea, providing that the Frigg Field Reservoir 'shall be exploited as a single unit'.[1060] The Frigg Treaty set the standard for subsequent unitization treaties by containing provisions that were to become commonplace.[1061] Each state agreed to cause its license concessionaires to reach an agreement with the license concessionaries of the other state to implement the provisions of the Frigg Treaty; the resulting agreement between the concessionaires required approval of the relevant states.[1062] The states would jointly determine the limits of the field and would attempt to agree on apportionment of the reserves prior to production.[1063] In addition, the license concessionaries would appoint a single unit operator[1064]; landing facilities were to be freely accessible to each party[1065]; the states would cooperate on safety[1066]; each state retained its own taxation regime[1067]; license rights could not be transferred nor could new rights be granted without approval of the other state[1068], and a special commission was established to address issues referred to it by the states.[1069] Transmission of the gas to shore

[1058] Ana E Bastida and others, "Cross-Border Unitization and Joint Development Agreements: An International Law Perspective' (2006-2007) 29 Houston Journal of International Law 355, 370
[1059] James E Horigan, 'Unitization of Petroleum Reservoirs Extending Across Sub-Sea Boundary Lines of Bordering States in the North Sea' (1974) 7 Natural Resources Law 67, 73
[1060] Agreement between the Government of the United Kingdom of Great Britain and Northern Ireland and the Government of the Kingdom of Norway relating to the Exploitation of the Frigg Field Reservoir and the Transmission of Gas therefrom to the United Kingdom (adopted 10 May 1976, entered into force 20 July 1978) Cmnd 6491, Art. 1(1) (Frigg Treaty)
[1061] The treaty between Norway and Russia, which both delimits the maritime boundary and provides for joint development, is a recent example. Treaty between the Kingdom of Norway and the Russian Federation concerning Maritime Delimitation and Cooperation in the Barents Sea and the Arctic Ocean (15 September 2012)
[1062] ibid art 1(2)
[1063] ibid art 2
[1064] ibid art 5
[1065] ibid art 6
[1066] ibid art 7-8
[1067] ibid art 9
[1068] ibid art 10
[1069] ibid art 27

via pipelines was addressed[1070], and separate annexes listed the equipment to be installed[1071] and the exact location of the four wells.[1072] Subsequent agreements between the UK and Norway for the Statfjord, Murchison and Markham oil fields all followed the pattern of the Frigg Treaty.[1073]

By the time that William Onorato published a paper on the topic of offshore oil and gas development in 1977, state practice with respect to commonly held offshore oil and gas resources had become so consistent that he felt confident in saying that 'there are now quite definite principles and rules of law to be applied . . . .'[1074] First, no state may unilaterally exploit a common resource over the reasonable objection of another state that has claim to that resource. Secondly, states must agree on the method and legal basis used to exploit the resource. Third, states were obliged to enter into negotiations regarding apportionment of the resource. Fourth, while international law regarding the substance of agreements had not yet been formed, states wishing to form an agreement could look to certain other bodies of law and practice for analogies. Those other bodies of law and practice could include domestic laws requiring unitization and international laws that pertain to resources similar to petroleum or that had influenced *opinio juris* due to consistent state practice with respect to petroleum.[1075] Several of these principles have obvious synergies, if not origins, in laws of the sea, such as the sovereign right of a state to exclusive development of its continental shelf resources and the requirement by LOSC and the ICJ *North Sea Continental Shelf Cases* to enter into negotiations with other concerned states to resolve disputed rights. The continuing influence of

[1070] ibid art 13-21
[1071] ibid Annex A
[1072] ibid Annex B
[1073] Peter D Cameron, 'The Rules Of Engagement: Developing Cross-Border Petroleum Deposits In The North Sea And The Caribbean' (2006) 55 International & Comparative Law Quarterly 559, 572
[1074] William T Onorato, 'Apportionment Of An International Common Petroleum Deposit' (1977) 26 International & Comparative Law Quarterly 324, 327
[1075] ibid 327-328. Onorato restated these principles in a later article. *See* William T Onorato, 'Joint Development Of Seabed Hydrocarbon Resources: An Overview Of Precedents In The North Sea' (1981) 6 Energy 1311, 1311-1312 (Onorato 1981).

international water law principles such as reasonable and equitable utilization and cooperation is also apparent.

Another legal expert on offshore oil and gas exploration, Rainer Lagoni, published an article in 1979 noting that, since the time that the UK-Norway delimitation treaty was signed in 1965[1076], many states had included a minerals deposit clause in their continental shelf delimitation treaties, obligating them to cooperate in development of any mineral deposits that are found to be commonly-held resources.[1077] This type of provision, also known as a straddle deposit clause, is found in most maritime delimitation agreements.[1078] Calling the practice 'striking in its uniformity'[1079], Lagoni suggested that the wide acceptance of mineral deposit clauses evidenced an emerging principle of customary law requiring cooperation in development of commonly-held offshore mineral deposits.[1080] In addition, he cited judicial decisions such as the *North Sea Continental Shelf Cases* and *Lake Lanoux* in opining that such transboundary cooperation had achieved the standard of *opinio juris* that is necessary for the practice to be considered as customary law.[1081] He went on to describe four types of cooperation agreements then in use: geological cooperation in mining the deposit[1082]; joint operations by the states' concessionaires[1083]; unitized development of a defined field or a common resource (unitization)[1084], and 'a functionally limited condominium' whereby

[1076] Agreement Between the Government of the United Kingdom of Great Britain and Northern Ireland and the Government of the Kingdom of Norway Relating to the Delimitation of the Continental Shelf Between the Two Countries (adopted 10 March 1965, entered into force 14 January 1966) 551 UNTS 214
[1077] Lagoni (n 1053) 229
[1078] David M. Ong, 'The 1979 and 1990 Malaysia-Thailand Joint Development Agreements: A Model for International Legal Co-operation in Common Offshore Petroleum Deposits?' (1999) 14 The International Journal of Marine and Coastal Law 207, 216 (Ong 1999)
[1079] Lagoni (n 1053) 229. In his article, Lagoni listed contemporary delimitation treaties with mineral deposit clauses covering the North Sea, Baltic Sea, the Gulf of Biscay, the Mediterranean Sea, the Adriatic Sea, the Persian Gulf and the Red Sea. ibid 229-230
[1080] ibid 233
[1081] ibid 235
[1082] ibid 222-223
[1083] ibid 223
[1084] ibid 224

the states exercise joint power over the resource.[1085] Like others before and after him, Lagoni referenced the international law of river basins as an analogous precedent, not only for protecting the unity of a deposit, but also for equitable apportionment of a common resource.[1086] A few years later, William Onorato declared that cooperative development had become both economically necessary and legally required whether or not the marine boundary between two or more states has been delimited.[1087]

While LOSC and the ICJ provided limited guidance on delimiting marine boundaries that served to steer states to self-constructed resolutions, no such guidance was available for transboundary marine natural resources,[1088] and states were relegated to crafting their own solutions.[1089] As stated earlier, LOSC provides that a state retains sovereignty over its territorial sea[1090] and sovereign rights over the natural resources of the seabed of its EEZ[1091] and the outer continental shelf[1092]. By agreeing to develop a common oil or gas field in cooperation with a neighboring state, especially where that development involves establishing a joint committee, one could argue that the state was conceding some of its sovereign rights to another state or to the committee. This issue was recognized even as early as the Frigg Treaty, and to protect themselves against such vulnerabilities states entering into a unitization arrangement to develop an identified common field specifically preserved their sovereign rights under international law to resources in the continental shelf.[1093] Given the vast sums of money that accrued from offshore oil and gas development, taking the small risk that treaty language would not completely

[1085] ibid 226-228
[1086] ibid 236. See also Masahiro Miyoshi, 'Some Comments On Legal Aspects Of Precedents For Joint Development' (1981) 6 Energy 1359, 1360 (Miyoshi 1981)
[1087] William T Onorato, 'A Case Study in Joint Development: The Saudia Arabia-Kuwait Partitioned Neutral Zone' (1985) 10 Energy 539, 539-540
[1088] Alberto Szekely, 'The International Law of Submarine Transboundary Hydrocarbon Resources: Legal Limits to Behavior and Experiences for the Gulf of Mexico' (1986) 26 Natural Resources Journal 733, 738, 743
[1089] ibid 758
[1090] LOSC (n 1035) art 2
[1091] ibid art 56(1)(a)
[1092] ibid art 77(1)
[1093] Frigg Treaty (n 1060) art 29(1). See also Onorato 1981 (n 1075) 1314

protect sovereignty over natural resources must have seemed like a wise wager to make.[1094]

In conclusion, with unitization, the parties agree on how the benefits of an identified resource will be allocated between them. Therefore, almost by its very essence, unitization embodies an agreement that signifies the parties' understanding of reasonable and equitable use of the resource. At the same time, unitization and joint development structures use commercial priorities to implement a common approach to exercising and protecting their community of interests. Regarding the principle of not allowing significant harm to befall the resource, once again unitization fulfills the essence of the principle, since the parties generally agree to appoint a single operator for development, with the precise goal of preserving the resource and maximizing efficient recovery. Data sharing is a hallmark of collaborative ventures, and the joint committees that are created in nearly every treaty discussed so far serve as the recipients of data and information. Indeed, a joint development operation would be stymied without sharing adequate information and data about the resource.[1095] Thus, a comparison between the unitization practices and international water law reveals that they are compatible and mutually reinforcing, and unitization actually meets both the letter and the spirit of international water law principles.

4.1.3 Joint Development Agreements and the Framework Agreement

Unitization of transboundary oil and gas fields became commonplace in a relatively short period of time, but the practice addressed only exploitation after a field had been identified and designated. The next legal structure wherein states voluntarily limited their sovereignty and embraced a communal approach

[1094] Miyoshi 1981 (n 1086) 1359

[1095] In his doctoral thesis under the supervision of Rainer Lagoni, Vasco Becker-Weinberg concluded that certain international obligations accompany straddling deposits of natural resources such as oil, gas and minerals: mutual restraint, negotiation, data sharing and respect for sovereignty. Vasco Becker-Weinberg, *Joint Development of Hydrocarbon Deposits in the Law of the Sea* (Springer 2014) 8, 72

to development evolved from the desire to cooperate on exploration as well as exploitation. The structure of a joint development agreement (JDA) allowed the parties to share the significant costs and risk they face in the early stages of developing a shared field while searching for oil and gas reserves suitable for development. Generally speaking, a unitization agreement formalizes joint exploitation of a known oil or gas pool, whereas in a JDA the state parties select an area where oil and/or gas reserves are expected to be found and agree to joint exploration and exploitation.[1096] The maritime boundaries between the states need not be finally agreed in order for them to cooperate in developing common offshore resources through a JDA.[1097]

In 1999 David Ong described three types of JDAs: (1) one state performs the development and the other state shares in the net profits after costs are deducted; (2) the states form a sort of joint venture with each of them involved in approving any joint operating agreements and with a joint commission being delegated limited powers, and (3) the states delegate much of the development responsibility and operation to a strong joint commission.[1098] Since use of JDAs was quickly and widely adopted in certain parts of the world, Ong argued that a regional rule of customary international law had arisen requiring JDAs to be formed in those areas where they were most regularly found, such as the North Sea, the Persian Gulf and Southeast Asia.[1099] While the obligation to create a JDA may be only a regional requirement, there remained firm rules of international customary law applicable to all shared resources that required states to cooperate in trying to craft a cooperation agreement and to share information.[1100] Exploration could proceed unilaterally, assuming that the activity caused no harm to the other state's sovereign interests, but exploitation

[1096] Ana E Bastida et al (n 1058) 358-359
[1097] Paul Michael Blyschak, 'Offshore oil and gas projects amid maritime border disputes: applicable law' (2013) 6 Journal of World Energy Law and Business 210, 217
[1098] Ong 1999 (n 1078) 788-791
[1099] ibid 795
[1100] ibid 798

of a shared natural seabed resource had to be agreed by the relevant states,[1101] thus putting the rule of capture firmly to rest.[1102]

In a 2002 article, Ong cited William Onorato and Mark Valencia in listing the components of a traditional JDA:

> (i) a treaty designating the geographical area subject to the joint development regime, (ii) the establishment of some form of international joint body, composed of equal representatives from both parties, (iii) the grant of exploration and exploitation rights over the designated joint development area, either by the parties or the established joint body, and (iv) the nomination by the individual rights holders of a single operator to exploit the deposits in the designated area.[1103]

Given the positive practical, economic and legal characteristics of JDAs, more than a dozen have been completed around the world, both where maritime boundaries were delimited and where they were still in dispute. In 1999 Masahiro Miyoshi compiled a list of JDAs then in force[1104]:

JDAs where the maritime boundary was not delimited:

- 1974 Japan - South Korea Joint Development Agreement[1105]
- 1979 Malaysia-Thailand Memorandum of Understanding[1106]

[1101] ibid 800
[1102] ibid 802
[1103] David M Ong, 'The New Timor Sea Arrangement 2001: Is Joint Development of Common Offshore Oil and Gas Deposits Mandated under International Law?' (2002) 17 International Journal of Marine & Coastal Law 79, 95
[1104] Masahiro Miyoshi, 'The Joint Development of Offshore Oil and Gas in Relation to Maritime Boundary Delimitation' in Clive Schofield (ed) *Maritime Briefing, Vol 2* (University of Durham 1999) 6-39 (Miyoshi 1999) Several of these agreements will be discussed in greater detail in Chapter 4.3 below.
[1105] Agreement between Japan and the Republic of Korea concerning Joint Development of the Southern Part of the Continental Shelf Adjacent to the Two Countries (adopted 30 January 1974, entered into force 22 June 1978) 1225 UNTS 114 (1974 Japan-South Korea Agreement)
[1106] Memorandum of Understanding between Malaysia and the Kingdom of Thailand on the Establishment of the Joint Authority for the Exploitation of the Resources of the Seabed in a Defined Area of the Continental Shelf of the Two Countries in the Gulf of Thailand (adopted 21 February 1979, entered into force 24 October 1979) (1979 Malaysia-Thailand MOU) As will be

- 1989 Timor Gap Treaty between Australia and Indonesia[1107]
- 1992 Malaysia – Vietnam Memorandum of Understanding[1108]
- 1993 Jamaica-Colombia Treaty[1109]
- 1995 Argentina – United Kingdom Joint Declaration[1110]

JDAs where the maritime boundary was delimited:

- 1958 Bahrain-Saudi Arabia Agreement[1111]
- 1974 France – Spain Agreement[1112]

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discussed below in Chapter 4.3.6, the parties subsequently entered into a more definitive agreement in 1990.

[1107] Treaty on the Zone of Cooperation in an Area between the Indonesia Province of East Timor and Northern Australia (adopted 11 December 1989, entered into force 9 February 1991) 1654 UNTS 105, 29 ILM 469 (1990). After East Timor achieved independence from Indonesia, the newly independent nation signed two additional treaties with Australia addressing development of offshore hydrocarbons, but without delimiting their maritime boundary. Agreement between the Government of Australia and the Government of the Democratic Republic of Timor-Leste relating to the Unitization of the Sunrise and Troubadour Fields (adopted 6 March 2003, entered into force 23 February 2007) 2483 UNTS 317; Treaty between Australia and the Democratic Republic of Timor-Leste on Certain Maritime Arrangements in the Timor Sea (adopted 27 June 2006) 2483 UNTS 359. Timor-Leste later contested the validity of the latter treaty amid allegations of spying by Australia. Helen Davidson and Christopher Knauss, 'Australia and Timor-Leste to sign deal on contentious gasfield' (*The Guardian*, 6 March 2018) <https://www.theguardian.com/world/2018/mar/07/australia-and-timor-leste-to-sign-deal-on-contentious-gasfield> accessed 7 March 2018 On 6 March 2018, Timor-Leste (the official name of East Timor) and Australia reached agreement on their delimited boundary utilizing the median line method. Anne Barker, 'Australia and East Timor maritime agreement could 'unravel' borders with Indonesia' (*ABC News*, 6 March 2018) <http://www.abc.net.au/news/2018-03-06/australia-east-timor-deal-could-unravel-border-with-indonesia/9515874> accessed 7 March 2018; Helen Davidson, 'Australia and Timor-Leste sign historic maritime border treaty' (*The Guardian*, 6 March 2018) <https://www.theguardian.com/world/2018/mar/07/australia-and-timor-leste-sign-historic-maritime-border-treaty> accessed 7 March 2018

[1108] Memorandum of Understanding between Malaysia and the Socialist Republic of Vietnam for the Exploration and Exploitation of Petroleum in a Defined Area of the Continental Shelf Involving the Two Countries (adopted 5 June 1992, entered into force 4 June 1993)

[1109] Maritime delimitation treaty between Jamaica and the Republic of Colombia (adopted 12 November 1993, entered into force 14 March 1994) 1776 UNTS 27 (1993 Jamaica-Colombia Treaty)

[1110] The United Kingdom and The Argentine Republic, Joint Declaration Of 27 September 1995 on Cooperation Over Offshore Activities In The South West Atlantic. In 2007 Argentina withdrew from the cooperation agreement. *See* Duncan Campbell, 'Falklands gulf widens as Argentina quits oil deal with UK' (*The Guardian*, 29 March 2007) <http://www.theguardian.com/uk/2007/mar/29/argentina.falklands> accessed 11 August 2017

[1111] Agreement concerning the Delimitation of the Continental Shelf between Saudi Arabia and Bahrain (adopted 22 February 1958, entered into force 26 February 1958)

[1112] Convention between the Government of the French Republic and the Government of the Spanish State on the Delimitation of the Continental Shelves of the two States in the Bay of

- 1974 Saudi Arabia – Sudan Agreement[1113]
- 1981 Iceland – Norway Agreement[1114]
- 1988 Libya – Tunisia Agreement[1115]
- 1993 Guinea-Bissau – Senegal Agreement[1116]

Since publication of Miyoshi's analysis, the 2001 Nigeria–São Tomé and Príncipe Joint Development Agreement has also been completed,[1117] as has the 2012 Agreement between the United States of America and the United Mexican States Concerning Transboundary Hydrocarbon Reservoirs in the Gulf of Mexico. [1118] Some of these JDAs have been agreed in regions outside of the areas identified by Ong in 1999 – the North Sea, the Persian Gulf and Southeast Asia – which suggests that the regional rule of customary law is now global.[1119]

The next step in the evolution of treaties for development of offshore resources was once again introduced by the United Kingdom and Norway for North Sea hydrocarbon deposits, through the mechanism of the 2005 Framework Agreement concerning Cross-Boundary Petroleum Co-operation (Framework

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Biscay (Golfe de Gascogne/Golfo de Vizcaya) (adopted 29 January 1974, entered into force 5 April 1975) 996 UNTS 333 (1974 France-Spain Bay of Biscay Treaty)

[1113] Agreement between Sudan and Saudi Arabia Relating to the Joint Exploitation of the Natural Resources of the Seabed and Subsoil of the Red Sea in the Common Zone (adopted 16 May 1974) 952 UNTS 193 (1974 Saudi Arabia-Sudan Treaty)

[1114] Agreement on the Continental Shelf Between Iceland and Jan Mayen (adopted 22 October 1981, entered into force 2 June 1982) 2124 UNTS 247

[1115] Agreement between the Libyan Arab Socialist People's Jamahiriya and the Republic of Tunisia to Implement the Judgment of the International Court of Justice in the Tunisia/Libya Continental Shelf Case (adopted 8 August 1988)

[1116] Management and Cooperation Agreement between the Government of the Republic of Sénégal and the Government of the Republic of Guinea-Bissau (adopted 14 October 1993, entered into force 21 December 1995) 1903 UNTS 4 (1993 Sénégal-Guinea-Bissau Agreement)

[1117] Treaty between the Federal Republic of Nigeria and the Democratic Republic of São Tomé and Príncipe on the Joint Development of Petroleum and other Resources, in respect of Areas of the Exclusive Economic Zone of the Two States (adopted and entered into force 21 February 2001) (2001 Nigeria-São Tomé and Príncipe Treaty) LEX-FAOC063136

[1118] Agreement between the United States of America and the United Mexican States Concerning Transboundary Hydrocarbon Reservoirs in the Gulf of Mexico (adopted 20 February 2012, entered into force 16 July 2013) TIAS No 14-718

[1119] A 1999 arbitral panel in a dispute in the Red Sea pronounced that the parties 'should give every consideration to the shared or joint or unitised exploitation of any . . . [straddling] resources'. Eritrea-Yemen Arbitration (Phase II—Maritime Delimitation) case, Arbitral Tribunal Award of 17 December 1999, para 86

Agreement).[1120] With this agreement, the UK and Norway departed from the JDA pattern whereby each field was the subject of a separate agreement. Instead, the two states agreed on terms that would apply to any designated 'Cross-Boundary Project', which could include construction and operation of a cross-boundary pipeline, exploration for and exploitation of a transboundary oil or gas field, construction and operation of an installation for use in exploration and/or exploitation, and use of what are termed 'Host Facilities' that are utilized by the parties to explore and develop fields outside of the geographical limits of the agreement.[1121]

In many respects, the provisions of the Framework Agreement bear resemblance to JDAs, with states agreeing to use 'best efforts to facilitate Cross-Boundary Projects'[1122], to exchange information[1123], to form a committee to facilitate the agreement[1124], to grant necessary authorizations[1125], and to require their respective licensees to reach an agreement regulating the transboundary reservoir[1126] and to appoint a single operator[1127]. The licensee agreement must be submitted to both governments and, to streamline the process, the license agreement is deemed to be approved unless the licensees are notified otherwise within 60 days of receipt by the government of the agreement.[1128] The appointment of the initial unit operator and any replacement operator requires approval of both governments.[1129] Once again, to avoid any doubt on the matter, the states declare that the Framework Agreement will not affect their sovereign rights to the continental shelf under

[1120] Framework Agreement between the Government of the United Kingdom of Great Britain and Northern Ireland and the Government of the Kingdom of Norway concerning Cross-Boundary Petroleum Co-operation (adopted 4 April 2005, entered into force 10 July 2007)
[1121] ibid art 1.2
[1122] ibid art 1.4(1)
[1123] ibid art. 1.10
[1124] ibid art 1.15
[1125] ibid arts 2.1(1), 3.1(2)
[1126] ibid art 3.2(1)
[1127] ibid art 3.7
[1128] ibid art 3.2(2)
[1129] ibid art 3.7

international law.[1130] Offshore pipelines and hydrocarbon development projects covered under six prior treaties ranging from 1973 to 1998, including the iconic Frigg Treaty, are specifically excluded from the Framework Agreement.[1131] Instead, two small oil fields and a gas transmission project were coupled with the Framework Agreement at the time of its announcement.[1132] Since the Framework Agreement is so recent, not enough time has passed to know whether its comprehensive and practical approach to development of offshore resources will become an accepted trend. The framework structure may indeed represent a new paradigm of pre-negotiating terms and conditions and then assigning identified fields, or it may eventually simply reflect market terms in 2005.

In summary, the customary laws and practices of offshore hydrocarbon development have evolved and solidified through state practice. Even in the absence of fully delimited boundaries, states enter into agreements to collaborate on exploration and exploitation of transboundary fields. These agreements generally designate a geographical area to fall within the scope of the agreement and provide that the states will cause a single operator to develop a designated field or fields. This approach has obvious practical benefits, since use of a single operator eliminates any risk of a drilling race to the bottom of the resource pool by competing developers. In addition, sharing of data and information through the mechanism of a single operator aids in maximizing efficient extraction. Concerns about waivers of sovereign rights are addressed in the agreements by preserving all rights under international law, yet by agreeing to collaborative development of shared natural resources nations in effect limit their sovereign claims to full ownership of the resources. These limitations are clearly viewed as an acceptable trade-off in return for the financial benefits that are achieved from extracting and selling hydrocarbons.

[1130] ibid art 1.3
[1131] ibid art 1.2 and Annex E
[1132] Cameron (n 1073) 576

Practices and legal structures such as unitization, JDAs and the Framework Agreement have arisen in an attempt to streamline development of economically valuable resources that are located in challenging offshore environments in geological formations that are susceptible to contamination and inefficient depletion from uncoordinated activities. As noted, the pattern of cooperation in utilization of a shared resource that was adopted by the hydrocarbon industry took inspiration from international water law, which has for centuries supported collaborative approaches to transboundary rivers. When exploitation of freshwater in offshore transboundary aquifers and methane hydrates begins, the practice of collaboration in utilization of freshwater resources will have extended from the land to the sea. Certain ICJ decisions regarding maritime delimitations have had a profound impact on development of offshore transboundary hydrocarbons, and the next section will describe those decisions since some offshore freshwater deposits will almost certainly straddle maritime boundaries.

4.2 Judicial guidance on offshore hydrocarbon development

4.2.1 North Sea Continental Shelf Cases

In the wake of the modern extension of sovereign interests over continental shelf natural resources that was inaugurated by the Truman Proclamation and with improving technology for exploitation of those natural resources, exploration for offshore oil and gas reserves began in earnest in the immediate post-WWII period.[1133] In 1967, only three years after the Convention on the Continental Shelf entered into force, the Federal Republic of Germany (Germany), Denmark and the Netherlands asked the ICJ to render an opinion on the extent of their respective rights in their shared continental shelves after negotiations among the parties proved fruitless.[1134] The ICJ's statements in the

[1133] Hance D Smith and Tara Thrupp, 'Oil and Gas' in Hance D Smith and others (eds) *Routledge Handbook of Ocean Resources and Management* (Routledge 2015) 269
[1134] *North Sea Continental Shelf Cases* (n 1035) para 9

1969 *North Sea Continental Shelf Cases* have served as useful precedent regarding maritime transboundary issues ever since their publication.

At the heart of the North Sea dispute was the weight to be given to Article 6 of the Convention on the Continental Shelf, which stated that, unless the parties otherwise agreed and in the absence of special circumstances, the boundary on the continental shelf between two adjacent states will be determined by drawing a line that is equidistant between them. Germany argued that application of the equidistant method would produce an unfair and inequitable result[1135] and that the equidistant method did not have the status of customary law[1136]. Further, while all three states had signed the Convention on the Continental Shelf, Germany had not ratified it,[1137] and thus argued that the convention's provisions were not binding on it.[1138] The reason for Germany's reluctance to have the convention apply to its offshore interests originates from the negative effect that the equidistant method of Article 6(2) of the convention would have on states such as Germany that have concave coastlines.[1139]

The ICJ began its legal analysis of the case with a review of the accepted fundamental principles pertaining to sovereignty over the continental shelf. Most fundamental, according to the court, is that a state's inherent sovereign right to explore the seabed and exploit the natural resources of its continental shelf derive from the state's sovereignty over the land itself, since the continental shelf is a natural prolongation of the state's land territory.[1140] A state's right over its continental shelf and the resources contained therein is exclusive, and no other state may explore or exploit the area without the other state's consent.[1141] The court then agreed with Germany that the Convention on

[1135] ibid para 7
[1136] *North Sea Continental Shelf Cases (Federal Republic of Germany/Denmark; Federal Republic of Germany/Netherlands)* (Pleadings, Oral Arguments, Documents, Vol II) (1968) 13
[1137] *North Sea Continental Shelf Cases* (n 1040) para 26
[1138] ibid para 15
[1139] ibid paras 3-5, 8
[1140] ibid paras 19, 39, 43
[1141] ibid

the Continental Shelf was not binding on that state because it had not ratified the convention, and its conduct did not support an argument of estoppel.[1142]

Turning to the question of whether the equidistant method had become a tenet of customary law such that Germany was bound to utilize it[1143], the court recognized that 'no other method has the same combination of practical convenience and certainty of application'.[1144] The court gave credence to the Truman Proclamation in acknowledging that the proclamation was widely seen as the progenitor of 'positive law' with respect to continental shelves, and the resulting pattern of delimitation of boundaries through mutual agreement and equitable principles had been closely followed.[1145] The ICJ noted that, in drafting the Convention on the Continental Shelf, the UNILC had not proposed the equidistant method to delimit the boundary on the continental shelf of adjacent states until after a committee of 'hydrographical' experts suggested the concept in a report to the UNILC.[1146] Indeed, 'the notion of equidistance [was] never considered from the standpoint of its having *a priori* a character of inherent necessity.'[1147] The ICJ suggested that the experts had proposed the equidistant method due to its practical convenience and not because of any legal grounding[1148]. Therefore, the UNILC's adoption of the method for the Convention on the Continental Shelf did not represent proof of emerging customary international law[1149] nor did subsequent practice of states confer that status on the equidistant method.[1150] Interestingly, not all of the Convention's methods of delimitation were dismissed, for the court supported using the Convention's median line method for delimitation between two states with opposite coasts.[1151]

[1142] ibid paras 27-30
[1143] ibid para 21
[1144] ibid para 23
[1145] ibid para 47
[1146] ibid para 50
[1147] ibid
[1148] ibid para 53
[1149] ibid paras 62, 69
[1150] ibid para 81
[1151] ibid paras 57-58

Having rejected the use of the equidistant method of delimitation, the ICJ then listed the main principles that should guide states in determining boundaries on continental shelves: an obligation to negotiate with an intent to reach an agreement, an obligation to apply equitable principles, and an acknowledgement that a state's claim to a continental shelf must only be based on the natural prolongation of its own territory, without infringement on any other state's natural prolongation.[1152] With respect to the factors to be considered in delimitation, the court noted the practice of protecting the unity of natural resource deposits as a means of enabling more efficient exploitation, a practice that had already begun in the North Sea through agreements entered into during the 1960s by the United Kingdom, Norway, Germany, and the Netherlands.[1153] Other factors to be weighed included the configuration of the coastline (taking into account any special or unusual features), the physical and geological structure of the shelf, and 'a reasonable degree of proportionality'.[1154]

Judge Jessup explained in his separate opinion that the *North Sea Continental Shelf Cases* were clearly about ownership of oil and gas deposits in the continental shelves.[1155] In support of that observation, he made special mention of the contemporary North Sea agreements for joint exploitation of deposits[1156] as well as agreements concerning deposits in the Adriatic Sea and the Persian Gulf.[1157] As already noted, in finding additional precedent for cooperation with respect to exploitation of natural resources, Judge Jessup took note of the long history of states sharing water resources.[1158]

Thus, in the early days of exploration and exploitation of natural resources contained in transboundary continental shelves, the *North Sea Continental Shelf*

[1152] ibid para 85
[1153] ibid para 97
[1154] ibid para 101
[1155] Jessup Opinion (n 1050) 72-3
[1156] ibid 81-82
[1157] ibid 82-83
[1158] ibid

Cases provided guidance on several key points. States seeking to delimit the marine boundary between their adjacent continental shelves have an obligation to negotiate with a good faith intention to reach an agreement using equitable principles.[1159] Further, the natural prolongation of a state's land should guide claims of sovereignty and sovereign rights over its continental shelf. While no legal weight was given to protecting the unity of a deposit, both the ICJ judgment and Judge Jessup's separate opinion seemed to look favorably on agreements to develop a site jointly. Significantly, the provision of Article 6(2) of the Convention on the Continental Shelf regarding the equidistant method of delimitation between adjacent states was found not to represent customary law, and the ICJ questioned whether the equidistant method had any basis in law at all. Lastly and importantly, the ICJ acknowledged that existing practices for equitably sharing land-based freshwater served as suitable precedent for delimiting shared offshore natural resources as well.

4.2.2 Tunisia/Libyan Arab Jamahiriya and Libyan Arab Jamahiriya/Malta

Two additional cases regarding delimitation on continental shelves for purposes of offshore natural resources development were subsequently brought before the court. Both were decided in the 1980s, both featured Libyan Arab Jamahiriya (Libya) as a party, and both were initiated by a dispute over offshore hydrocarbons. However, one involved the continental shelf of adjacent states, while the other addressed the continental shelf of states with opposite coasts. In its judgment in the 1982 *Case Concerning The Continental Shelf between Tunisia and Libyan Arab Jamahiriya*[1160], the ICJ considered the evolution and

[1159] In 1971 Germany, Denmark, the Netherlands and the United Kingdom entered into a series of bilateral agreements delimiting their maritime boundaries in conformity with the decision rendered by the ICJ in the *North Sea Continental Shelf Cases.* Buzan (n 1040) 181. The text of the treaties is available in *The Law of the Sea: Maritime Boundary Agreements (1970-1984)* (United Nations 1987).

[1160] *Case Concerning The Continental Shelf between Tunisia and Libyan Arab Jamahiriya (Tunisia/Libyan Arab Jamahiriya)* (Judgment) (1982) ICJ Rep 18 (*Tunisia-Libya Case*). Three years later the ICJ adjudicated another dispute between Tunisia and Libya and clarified delimitation in the first ruling. See *Application for Revision and Interpretation of the Judgment of 24 February 1982 in the Case concerning the Continental Shelf (Tunisia/Libyan Arab Jamahiriya)* (Judgment) (1985) ICJ Rep 192.

current state of international law regarding the continental shelf of adjacent states as evidenced by the Third United Nations Conference on the Law of the Sea that was then in progress. The court noted that Article 76(1) of the draft LOSC defined the continental shelf with reference to the 'natural prolongation' of a state's land territory.[1161] Using natural prolongation as a framework for its analysis, the ICJ declared that it was 'bound to decide the case on the basis of equitable principles',[1162] even though the draft LOSC had eliminated explicit reference to equitable principles[1163] while retaining an obligation 'to achieve an equitable solution'[1164]. Thomas Franck called the ICJ's directed delimitation of the maritime boundary between the disputants 'an unusual exercise in judicial creativity' and credited the court with using equitable principles to craft 'a far greater and more openly distributive effect than in the diffident use of equity as a mere auxiliary principle in the *North Sea Continental Shelf Cases'.*[1165] The difference in approach and in the more directed outcome could be attributed to maturation of legal and political discourse regarding maritime boundary lines that was the product of the multi-decade LOSC process.

The 1985 *Case Concerning The Continental Shelf (Libyan Arab Jamahiriya/Malta)*[1166] involved two states with opposing coasts. Malta was a party to the Convention on the Continental Shelf, but Libya was not a party to that convention. At the time of this ICJ case both states had signed the 1982 LOSC, but the treaty had not yet come into force.[1167] Since Malta was a party to the Convention on the Continental Shelf, it initially proposed in 1965 to delimit the continental shelf between itself and Libya by drawing a median line, in accordance with the provisions of the convention. Libya did not respond to that

[1161] *Tunisia-Libya Case* (n 1160) para 45
[1162] ibid para 70
[1163] ibid para 49
[1164] LOSC (n 1035) art 83(1)
[1165] Thomas M Franck, *Fairness in International Law and Institutions* (Oxford University Press 1995) 69
[1166] *Case Concerning The Continental Shelf (Libyan Arab Jarnahiriya/Malta)* (Judgment) (1985) ICJ Rep 13 (*Libya-Malta Case*)
[1167] ibid para 26

suggestion for eight years.[1168] By the time the states requested the ICJ to adjudicate their dispute, Article 83(1) of LOSC had eliminated both the equidistant and median line methods of delimitation by providing that "[t]he delimitation of the continental shelf between states with opposite or adjacent coasts shall be effected by agreement on the basis of international law . . . in order to achieve an equitable solution."[1169] While Article 83(1) does not mention equitable principles, both parties agreed that equitable principles must play a role in reaching an equitable solution.[1170] The court recognized that the two hundred-mile EEZ was now part of 'modern law', and, while the EEZ principles had not 'absorbed' the continental shelf doctrines, the two concepts must be considered together.[1171] As a result, natural prolongation must now be determined at least in part by distance from shore.[1172] The court rejected Malta's argument that, since the two opposing coasts are less than four hundred miles apart, the equidistant method of delimitation should be employed to produce an equitable result,[1173] and provided a list of equitable principles to be utilized in delimiting maritime boundaries:

> . . . the principle that there is to be no question of refashioning geography, or compensating for the inequalities of nature; the related principle of non-encroachment by one party on the natural prolongation of the other, which is no more than the negative expression of the positive rule that the coastal State enjoys sovereign rights over the continental shelf off its coasts to the full extent authorized by international law in the relevant circumstances; the principle of respect due to all such relevant circumstances; the principle that although all States are equal before the law and are entitled to equal treatment, "equity does not necessarily imply equality" *(I.C.J. Reports 1969,* p. 49,

[1168] ibid para 24
[1169] ibid para 27; LOSC (n 1035) art 83(1)
[1170] *Libya-Malta Case* (n 1166) para 29
[1171] ibid para 33
[1172] ibid para 34
[1173] ibid paras 42-43

> para. 91), nor does it seek to make equal what nature has made unequal; and the principle that there can be no question of distributive justice.[1174]

In applying these principles to the case before it, the ICJ began with a median line between Libya and Malta and then adjusted it, giving Libya more territory to reflect its more expansive land and coastline.[1175] However, the court cautioned that adoption of a median line as a starting point for delimitation 'should not be understood as implying that an equidistance line will be an appropriate beginning in all cases, or even in all cases of delimitation between opposite states.'[1176]

As states begin to access and exploit offshore freshwater reserves, an understanding of acceptable methods of delimiting maritime boundaries will be essential in order to understand which claims of sovereign ownership will be upheld and where states will be forced to compromise and collaborate through legal structures such as unitization and JDAs. The ICJ decisions described in this section provide judicial guidance for drawing those boundaries. Yet joint development cannot proceed without an agreement between the sovereign nations regarding their rights and obligations toward each other, and that agreement is generally commemorated in a treaty. The following section describes a representative sample of treaties addressing offshore resources in order to highlight the variety of possible solutions.

4.2.3 Arbitral awards

Two recent arbitral awards are worth noting, as they both involve delimitation of disputed areas and both also involve activities related to development of a seabed natural resource.

[1174] ibid para 46
[1175] ibid para 78
[1176] ibid para 77

A maritime dispute between Guyana and Suriname produced an arbitral award[1177] that provides significant precedential value regarding development activities where the boundary has not yet been delimited. In 1998 Guyana awarded a concession contract to Canadian company CGX for part of the continental shelf that was claimed by both Guyana and Suriname. CGX conducted seismic tests in 1999 and in 2000 sent a ship to begin preparatory work for drilling, and Suriname sent two patrol boats to force the ship to detach the oilrig from the sea floor and leave the area.[1178] Guyana initiated arbitration in 2004.

The tribunal first delimited the boundary of the territorial sea between the two adjacent states, producing a line that took into account 'historical arrangements of an unusual nature'.[1179] The tribunal then used the equidistant method to delimit the EEZ and the continental shelf.[1180] More interestingly, the tribunal unanimously concluded that Guyana's use of threatened force in the disputed area was a breach of LOSC, of the UN Charter and international law and that the parties had both breached their obligations under LOSC Articles 74(3) and 83(3) to 'make every effort to enter into provisional arrangements . . . and . . . not to jeopardise or hamper the reaching of a final delimitation agreement'.[1181] In particular, the panel adopted the ICJ's position in the *Aegean Sea* case between Greece and Turkey that seismic activities relating to mere exploration of the seabed in a disputed area are not objectionable since 'seismic exploration does not involve any risk of physical damage to the seabed or subsoil', seismic 'activities are of a transitory character' and 'no operations involving the actual appropriation . . . . of the natural resources' is involved.[1182] From this case, one can conclude that states may unilaterally carry out non-invasive exploration of

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[1177] *In the Matter of an Arbitration Between Guyana and Suriname* (Guyana v Suriname) (Award) ICGJ 370 (PCA 2007) (*Guyana v Suriname*)
[1178] ibid paras 150-1 A good summary of the facts of this case can also be found in Blyschak (n 1093) 227-9
[1179] *Guyana v Suriname* (n 1177) para 323, 328
[1180] ibid para 392, 400
[1181] ibid para 448
[1182] ibid para 468, citing *Aegean Sea (Greece v Turkey)*, Interim Protection (Order) (1976) ICJ Reports 3, at para 30

the seabed in a disputed area, but the parties may not threaten one another or otherwise impede efforts to reach an equitable settlement.

Another case involved Ghana and Côte d'Ivoire, states that like Guyana and Suriname, have adjacent coastlines with disputed maritime boundaries and also have a history of offshore hydrocarbon development. The states sought arbitration through the International Tribunal for the Law of the Sea (ITLOS), which issued its judgment in September 2017.[1183] After first declaring that activities relating solely to petroleum development are 'of limited value in proving the existence' of a tacit agreement on maritime boundaries[1184], the tribunal found 'no convincing reason to deviate' from the equidistant method when delimiting the boundaries of the territorial seas, EEZs and continental shelves[1185]. Further, the location of mineral resources cannot be viewed as a special circumstance that would result in deviation from the equidistant method.[1186] The panel then decreed that activities undertaken by one state in a disputed area prior to delimitation are not a violation of the sovereignty of another state.[1187]

4.3 Treaties addressing offshore natural resources and minerals

As discussed in Chapter 1.2, offshore freshwater sheltered in seabeds can be found in both liquid and solid forms. Aquifers buried in the continental shelves contain fresh to slightly brackish liquid water, while the crystalline structures that capture and compress the methane in methane hydrates are composed of solid, frozen freshwater. The physical state of submarine freshwater – liquid or frozen -- carries legal significance when viewed through the lens of the treaties that govern transboundary offshore natural resources. These treaties can be

[1183] Dispute Concerning Delimitation Of The Maritime Boundary Between Ghana And Côte d'Ivoire In The Atlantic Ocean, Special Chamber of the International Tribunal for the Law of the Sea (ITLOS) (Judgment) (23 September 2017)
[1184] ibid para 226
[1185] ibid para 324
[1186] ibid para 455
[1187] ibid para 592

divided into three main categories. Broadest in scope are treaties addressing all offshore natural resources. Both liquid water in seabed aquifers and frozen water in methane hydrates would fall within the scope of these treaties. More limited in scope are treaties that address only minerals. Methane hydrates meet the definition of a mineral[1188], and therefore the accompanying freshwater would be covered under these treaties, while, liquid water in seabed aquifers would fall outside the scope of the mineral treaties. Finally, there are treaties that address only hydrocarbons. On first analysis, freshwater in any form would not be included within the scope of the hydrocarbon treaties, which limit themselves only to oil and natural gas. Yet, natural gas is composed of the hydrocarbon methane, and hydrocarbon-specific treaties would capture methane hydrates in their scope, with the fate of the frozen freshwater accompanying the methane hydrates not clearly determined by those treaty provisions. Thus, methane hydrates would be governed both by hydrocarbon treaties and by mineral treaties, and both methane hydrates and offshore aquifers would fall within the scope of treaties addressing natural resources generally.

Most, if not all, of the current treaties allocating rights to non-living offshore transboundary natural resources were initiated to facilitate development of bot hydrocarbon reserves that straddle agreed, delimited boundaries and those that lie in areas where international boundaries have not yet been agreed. In some cases the same treaty establishing the boundary lines between the parties also determined the rights of each party to the reserves that were estimated to lie on either side of a boundary line. In other cases, the hydrocarbon reserves may be known or estimated, but the parties were not able to agree on where to delimit

[1188] Under the generally accepted geologic definition, a mineral must be naturally occurring and inorganic with a definite chemical composition and an orderly, normally crystalline, internal structure. Robert L Bates & Julia A Jackson (eds), *Glossary of Geology* (2nd edn, Times Books 1980) 401; Edwin L Clopton, 'Ice as a Mineral' (1994) 69 *Rocks & Minerals* 90, 90; Frank R Spellman & Melissa L Stoudt, *The Handbook of Geoscience* (The Scarecrow Press, Inc. 2013) 185. The frozen freshwater in a methane hydrate forms a crystalline structure that the methane fills without forming its own crystalline structure. Therefore, a methane hydrate's freshwater can be classified as a mineral, but strictly speaking the methane would not fall within the definition of a mineral since it is gas.

the boundaries. Entering into a treaty in these circumstances allows for development of the reserves without the necessity of reaching an agreement about exactly where the boundary lines might lie.

Treaties addressing offshore transboundary natural resources span a wide spectrum of resources, rights and structures, and treaties addressing only offshore transboundary minerals also vary in content and management system. Chapter 4.1 above listed several of the most notable treaties addressing offshore transboundary hydrocarbons, and the next section of the chapter will explore in chronological order a representative sampling of those treaties that address non-living offshore transboundary natural resources and those that address transboundary offshore minerals.[1189] Should offshore freshwater in liquid or solid form be found in quantities sufficient enough to encourage development at a price adequate to produce a profit, then the current treaties will certainly be consulted for relevance and applicability. Through analysis of how states choose to protect their sovereign interests in shared natural resources that lie offshore, an understanding of various approaches to achieving an equitable solution may begin to form.

4.3.1 Netherlands, Germany and the Ems Estuary

As described in Chapter 4.1.1, the Netherlands and Germany negotiated the first agreement to cover seabed natural resources, and this agreement took the form of a supplement to a treaty concerning cooperation on the Ems Estuary. The original Ems-Dollard Treaty[1190], signed in 1960 and consisting of fifty-four detailed articles, set forth various arrangements with respect to the Ems Estuary, primarily to ensure effective navigation, shipping, transportation and fishing on the river. In recognition that the exact boundary between them was in dispute, the parties agreed to reserve their respective legal positions regarding 'the question of the course of the international frontier in the Ems

[1189] Treaties that focus exclusively on living resources such as fisheries are outside the scope of this thesis.
[1190] Ems-Dollard Treaty (n 1055)

Estuary'.[1191] Two years later, the supplement to the original treaty was signed, and its first article defines the term 'natural resources' to mean 'all solid, liquid or gaseous underground substances for the extraction of which, under the mining legislation of one of the two Contracting Parties, a concession is required. . . '[1192] Hence, in order to bring offshore freshwater within the ambit of this treaty supplement, all that would be required is a domestic law requiring a mining concession. The parties agree generally to 'co-operate in a spirit of good-neighbourliness with respect to all questions arising in connexion with prospecting for and the extraction of natural resources underlying the Ems Estuary which may affect their interests.'[1193]

Germany and the Netherlands took a practical approach to development of resources in an area where the exact boundary line was in dispute. They agreed to draw a line bisecting the joint area[1194] that would serve as a temporary boundary for jurisdictional purposes. With that provisional line agreed, the parties were free to make clear arrangements for development on either side of it. German law applied to all activities on the German side of the line, and Dutch law applied to activities on the Netherlands side.[1195] The parties may grant concessions for the entirety of their part of the joint area, with the caveat that any concessions granted prior to or after entry into force of the supplement must be in accordance with the terms of that agreement,[1196] and the parties must notify each other of all concessions.[1197]

The true intent of the treaty supplement becomes clear in the third article, which states that articles 4 through 10 shall apply to 'deposits of petroleum and natural gas present in the frontier area before commencement of extraction and

[1191] ibid art 46(1)
[1192] Ems-Dollard Supplementary Agreement (n 1056) art 1
[1193] ibid art 2
[1194] ibid art 1
[1195] ibid art 4(1)
[1196] ibid art 4(2)
[1197] ibid art 4(3)

to other substances recovered in the course of extraction.'[1198] The parties agree that their respective concessionaires will share equally any extracted petroleum or natural gas as well as any expenses,[1199] and each party's concessionaires will extract resources from that party's territory[1200] while cooperating with the concessionaire of the other party[1201]. As William Onorato has remarked, such coordination and cooperation are the hallmarks of unitization arrangements, thus placing the Ems-Dollard arrangement on the vanguard of offshore unitization structures.[1202]

This first bilateral agreement for transboundary offshore natural resources sets forth an amicable arrangement for two neighboring countries to explore and extract natural resources along a disputed border and to share in both the proceeds and the expenses. Most details were left to be worked out at a later date by two nations who share a long diplomatic history and both of whom are parties to the UN Convention on the Continental Shelf. The Netherlands and Germany reached a formal delimitation agreement for the Ems Estuary in 1964 but without amending the provisions regarding resource exploitation.[1203] In 1971 the state-parties adopted another treaty wherein they delimited their shared boundary in the North Sea and agreed to adopt regulations and/or seek arbitration should straddling mineral deposits be found in the area.[1204]

4.3.2 Saudi Arabia, Iran and the Persian Gulf

In 1968, during a time when offshore hydrocarbon development was becoming increasingly prevalent, Iran and Saudi Arabia finalized a treaty that delimited the submarine boundaries between their two nations. The five brief articles of

[1198] ibid art 3
[1199] ibid art 5
[1200] ibid art 6
[1201] ibid art 7
[1202] Onorato 1977 (n 1074) 333
[1203] Treaty between the Kingdom of the Netherlands and the Federal Republic of Germany concerning the lateral delimitation of the continental shelf in the vicinity of the coast (adopted 1 December 1964, entered into force 18 September 1965) 550 UNTS 123
[1204] Netherlands-Germany North Sea Delimitation Treaty (n 1044) art 2

the treaty principally serve to recognize Saudi Arabia's sovereignty over the island of Al-'Arabiyah and Iran's sovereignty over the island of Farsi, both of which are in the Persian Gulf.[1205] Although neither nation was a party to the UN Convention on the Continental Shelf that called for the equidistant method of delimitation, the parties agreed that a twelve-mile territorial sea around each island would be recognized, and, where overlapping claims of sovereignty existed, they would use the equidistant method of delimitation starting 'at all points from the low water lines of the two islands'.[1206] The coordinates of the boundary lines between the two islands are also set forth.[1207] The parties then acknowledged each other's sovereignty 'for the purpose of the exploration for and exploitation of the natural resources of that area.'[1208] Once again, the focus on hydrocarbons becomes clear through a provision in the treaty prohibiting any drilling for oil within 500 meters on either side of the boundary line set forth between the two islands.[1209] In contrast with the Ems-Dollard Treaty, which set forth broad parameters for cooperation on extraction of hydrocarbons in the absence of an agreement on a boundary line, this treaty delimits the marine boundary between two islands and prohibits either party from accessing the petroleum resources along that line. Oil deposits that may straddle the boundary line are not addressed.

4.3.3 France, Spain and the Bay of Biscay

France and Spain, both parties to the Convention on the Continental Shelf, entered into an agreement in 1974 to address shared natural resources in the Bay of Biscay[1210], a large body of water that creates a lengthy concave coastline

[1205] Agreement Concerning the Sovereignty over the Islands of Al-'Arabiyah and Farsi and the Delimitation of the Boundary Line Separating Submarine Areas between the Kingdom of Saudi Arabia and Iran (adopted 24 October 1968, entered into force 29 January 1969) 69 UNTS 212, art 1
[1206] ibid art 1
[1207] ibid art 3
[1208] ibid art 2
[1209] ibid art 4
[1210] 1974 France-Spain Bay of Biscay Treaty (n 1112) On the same day the two states signed another convention delimiting the territorial sea and contiguous zone. Convention between France and Spain on the delimitation of the territorial sea and the contiguous zone in the Bay of

along the western coast of France and the northern coast of Spain. The treaty served to delimit the marine boundary of the territorial sea between the two nations to a distance of twelve miles from shore[1211], and then created and divided a special zone on the continental shelf without delimiting the boundary lines[1212]. After setting forth the coordinates of the special zone, the parties then described their approach to exploiting transboundary natural resources in the continental shelf:

> If a deposit of natural resources is split by the boundary between the continental shelves and if that part of the deposit which is situated on one side of the boundary is exploitable, wholly or in part, by means of installations situated on the other side of the boundary, the Contracting Parties shall endeavour, together with the holders of exploitation licences, if any, to reach agreement as to the conditions for exploitation of the deposit, in order to ensure that such exploitation is as profitable as possible and in order that each Party may preserve its full rights over the natural resources of its continental shelf. In particular, this procedure shall apply if the mode of exploitation of that part of the deposit which is situated on one side of the boundary affects the conditions for exploitation of the other part of the deposit.[1213]

The provisions mandating an effort to find a mutually acceptable arrangement to maximize profitable exploitation of transboundary offshore resources may seem to dictate an obvious process that would occur naturally between two friendly neighbors. Five years prior to this treaty, the ICJ issued its opinion in the *North Sea Continental Shelf Cases*, holding that nations have an obligation to negotiate the terms of boundary delimitation and of shared natural resources by

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Biscay (Golfe de Gascogne/Golfo de Vizcaya) (adopted 29 January 1974, entered into force 5 April 1975) 996 UNTS 355

[1211] ibid art 1

[1212] ibid art 2

[1213] ibid art 4(1)

using equitable principles.[1214] By providing for an obligation in the treaty to negotiate, France and Spain were giving life to the ICJ judgment.

In Annex II to the treaty, the parties agreed to 'encourage the exploitation of the zone in such a way as to ensure an equal distribution of its resources'.[1215] In choosing to use the term 'equal', instead of 'equitable', the parties agreed to equal rights in the resources. Further, France and Spain agreed to encourage their respective concessionaires to reach their own agreements 'in order to allow companies having the nationality of the other Party to participate in such exploration on the basis of equal partnership and proportional financing of operations'.[1216] When an application for a license to explore the special zone is received, that state-party must notify the other state-party, and the latter state-party has six months to participate in the process of granting any licenses. Concessionaires who have formed partnership agreements for exploration and/or exploitation must notify the state-parties of any amendments to those agreements.[1217] In this way France and Spain maintain direct control over development operations in the special zone. In a provision that presaged future obligations to protect the environment, the parties agreed to cooperate in efforts to prevent exploration and exploitation activities from 'threatening the ecological balance and legitimate uses of the marine environment'.[1218] By the time of conclusion of this treaty, joint management commissions had already been utilized and would become standard in treaties of this type, but France and Spain elected to manage any operations and concessions themselves.

4.3.4 Saudi Arabia, Sudan and the Red Sea

In the same year that France and Spain formalized an agreement on the Bay of Biscay, Saudi Arabia entered into its second treaty regarding offshore natural resources, this time with Sudan to determine rights to natural resources lying

[1214] *North Sea Continental Shelf Cases* (n 1040) para 85
[1215] 1974 France-Spain Bay of Biscay Treaty (n 1112) Annex II, art 1
[1216] ibid Annex II, art 2
[1217] ibid Annex II, art 5
[1218] ibid art 8

under the Red Sea.[1219] The Red Sea is a narrow strip of water in a hydrocarbon rich area of the world that is shared by six nations: Saudi Arabia, Sudan, Eritrea, Egypt, Yemen and Jordan. Where the treaty for the Bay of Biscay was general in providing for consultations, the treaty for the Red Sea was specific about the rights and obligations of the parties. To begin, the term 'natural resources' is defined as 'non-living substances including the hydrocarbon and the mineral resources',[1220] and the two nations then 'covenant to co-operate through all ways and means to explore and exploit the natural resources of the sea-bed of the Red Sea'.[1221] After recognizing each other's exclusive sovereign rights to coastal areas out to an uninterrupted depth of one thousand meters and to their respective territorial seas[1222], the parties established a Common Zone between their exclusive areas,[1223] where they have equal sovereign rights to all natural resources without a clear boundary delimitation.[1224] In the opinion of Rainer Lagoni, this arrangement resembles a condominium of rights in the natural resources[1225], and Mark Valencia and Masahiro Miyoshi believe that the agreement between Saudi Arabia and Sudan was made possible by the 'feeling of solidarity' between the nations.[1226]

Additionally, the treaty set up a mutual defense obligation, where Saudi Arabia and Sudan agree to protect and defend their rights to natural resources in the Common Zone against all third parties.[1227] The parties then established a formal Joint Commission[1228] that was organized as a corporate body under the laws of Saudi Arabia[1229], with Saudi Arabia advancing the costs of its

[1219] 1974 Saudi Arabia-Sudan Treaty (n 1113)
[1220] ibid art I(2)
[1221] ibid art II
[1222] ibid art III, IV
[1223] ibid art V
[1224] ibid art VI
[1225] Lagoni (n 1053) 227
[1226] Mark J. Valencia & Masahiro Miyoshi, 'Southeast Asian Seas: Joint Development of Hydrocarbons in Overlapping Claim Areas?' [1986] 16 Ocean Development and International Law 211, 217
[1227]1974 Saudi Arabia-Sudan Treaty (n 1113) art VI
[1228] ibid art VII
[1229] ibid art VIII

operations[1230]. The body was given responsibilities and powers that included delimiting the Common Zone, undertaking studies relating to exploration and exploitation, and rendering decisions on applications for licenses and concessions[1231]. The Joint Commission also had the authority to reconsider licenses that had already been awarded by Sudan in 1973.[1232] Should any natural resource deposits be found to straddle the Common Zone and the areas of exclusive sovereignty of either party, the Joint Commission was given the power to decide on exploitation, provided that it ensured 'an equitable share in the proceeds' for the concerned government.[1233] The strong Joint Commission established in this treaty enjoyed a separate corporate identity and was given powers to make decisions regarding exploration and exploitation of shared natural resources, a solution that would be replicated in subsequent treaties for offshore natural resource development. Exploration and exploitation of natural resources is the primary focus of the treaty, and no provisions address protection of the marine environment.

4.3.5 Japan, South Korea and the East China Sea

It is no coincidence that the France-Spain and Saudi Arabia-Sudan treaties, as well as the Japan-South Korea treaty, were signed in 1974. The oil embargo imposed by OPEC in October 1973 would end in March 1974, and nations had begun a search to secure access to critically important oil supplies. Japan and South Korea likewise wanted to develop domestic oil supplies, and, together with Taiwan, entered into a race to lay stake to seabed territory. By the early 1970s, these three nations had established seventeen seabed zones, only four of which were uncontested, and concessions were granted in many of the zones.[1234] Unable to reach agreement on delimitation of the southern part of the continental shelf in the East China Sea but desirous of exploiting natural

[1230] ibid art XII
[1231] ibid art VII
[1232] ibid art XIII
[1233] ibid art XIV
[1234] Choon-Ho Park, 'Joint Development Of Mineral Resources In Disputed Waters: The Case Of Japan And South Korea In The East China Sea' [1981] 6 Energy 1335, 1335

resources, Japan and South Korea signed a joint development agreement in January 1974, one day after signature of the treaty between France and Spain regarding the Bay of Biscay.[1235] According to Masahiro Miyoshi, the Japan-South Korea Joint Development Agreement was the first to apply the notion of joint development where the parties were unable to agree on boundary limitation.[1236]

While using the term 'natural resources', this treaty defined them with reference to petroleum and natural gas, two products very much in demand at the time: '"natural resources" means petroleum (including natural gas) resources and other underground minerals which are produced in association with such resources.'[1237] Since natural gas is composed primarily of methane, and water in solid, mineral form is produced in association with methane in hydrates, any transboundary water resources consisting of methane hydrates would fall under the scope of this treaty.

As usual with joint development agreements, the treaty begins by designating the coordinates of the Joint Development Zone[1238] and in addition provides that the Joint Development Zone may be subdivided into subzones[1239], with the precise coordinates for the nine subzones detailed in the appendix to the treaty.[1240] The treaty then states that each party 'shall' appoint one or more concessionaires for each subzone[1241] and mandates that all concessionaires of both parties enter into an operating agreement that, among other things, will provide '[d]etails relating to the sharing of natural resources and expense' and will designate a single operator[1242]. Any operating agreement must be approved by the two nations, and approval is assumed unless an objection is made within two months after submission of the operating agreement to the

[1235] 1974 Japan-South Korea Agreement (n 1105)
[1236] Miyoshi 1999 (n 1104) 1. The Saudi Arabia-Sudan agreement was signed five months later.
[1237] 1974 Japan-Korea Agreement (n 1105) art I(1)
[1238] ibid art II(1)
[1239] ibid art III(i)
[1240] ibid Appendix. In 1987 the nine subzones were reduced to six. Miyoshi 1999 (n 1104) 13.
[1241] 1974 Japan-Korea Agreement (n 1105) art IV(1)
[1242] ibid art V

parties for their approval.[1243] The operator is given 'exclusive control of all operations' and 'shall . . . . employ all personnel required for such operations, pay and discharge all expenses incurred in connection with such operations, and obtain all assets, including equipment, materials, and supplies, necessary for carrying out such operations'.[1244] Concessionaires of each party are entitled to an equal share of the extracted natural resources, and expenses are to be shared in equal proportions.[1245]

Firm deadlines are imposed for exploration and extraction. While the term of the treaty is fifty years[1246] and certain subzones receive exemptions from some of the requirements[1247], in general the right to exploration lasts eight years from the date that the relevant operating agreement enters into force.[1248] When a 'commercial discovery' is made during exploration, the concessionaires must apply to the parties for an exploitation right.[1249] Once granted, the exploitation right lasts for thirty years, with the possibility of a five-year extension.[1250]

Concessionaires must remain active while possessing exploration and exploitation rights. Operations must start within six months of establishment of the right and may not be suspended for more than six months.[1251] A minimum number of wells must be drilled during the life of an exploration right, but the minimum number cannot exceed two wells in any subzone for the first and second three-year periods and for the final two-year period of the exploration right.[1252] A concessionaire's exclusivity to exploration in a subzone passes quickly, since twenty-five percent of the subzone must be released within three years after entry into force of the operating agreement, fifty percent must be

[1243] ibid art V(2)
[1244] ibid art VI(2)
[1245] ibid art IX
[1246] ibid art XXXI(2)
[1247] ibid Exchanges of Notes Ia
[1248] ibid art X(2)
[1249] ibid art X(4)(1)
[1250] ibid art X(3)
[1251] ibid art XII
[1252] ibid art XI (1)

released within six years, and seventy-five percent must be released within eight years.[1253] Concessions may be sold to outside parties with permission of the states and the other concessionaire[1254], and either state may, after consultation with the other state, cancel a concession if the concessionaire is not meeting its obligations.[1255] A detailed straddle deposit clause is also included.[1256] In order to protect the marine environment, the parties set forth a detailed list of measures to be taken by concessionaries to prevent, remove and report on pollution from development activities.[1257]

In addition to containing precise language about how concessions and rights are to be granted and administered, the treaty establishes a Japan-Republic of Korea Joint Commission 'as a means for consultations on matters concerning the implementation' of the agreement, and a permanent secretariat may also be constituted, with the parties sharing the expenses paid by the Commission.[1258] The Commission need meet only once per year, and its duties are relegated to oversight: observing and reviewing operation of the agreement, receiving technical and financial reports from the concessionaires, recommending dispute settlements and solutions to problems, and receiving notices.[1259] Thus, the Japan-South Korea joint commission was not granted many powers, and the two states retained much of the control over exploration and exploitation of natural resources.

4.3.6 Malaysia, Thailand and the Gulf of Thailand

The next treaty to include all offshore natural resources within its scope actually involved two agreements that were signed eleven years apart. In 1971 Malaysia and Thailand reached an understanding on delimitation of their northern shared continental shelf along the Straits of Malacca, but were unable to find

[1253] ibid art XIII(1)
[1254] ibid art X(6)
[1255] ibid art XIV
[1256] ibid art XXIII
[1257] ibid Exchanges of Notes 1c
[1258] ibid art XXIV
[1259] ibid art XXV

common ground with respect to their southern shared continental shelf along the coast of the Malaysian Peninsula in the Gulf of Thailand.[1260] However, both states wanted to proceed with hydrocarbon development in the disputed area. To move beyond the impasse, they signed a memorandum of understanding in 1979[1261] that provided the precise coordinates of the area with overlapping claims[1262] and established a Joint Authority[1263] that, similar to the Saudi Arabia-Sudan Joint Commission, was initially designed to have significant power over development of natural resources.

The Joint Authority was given a life of fifty years[1264] and broad authority to 'assume all rights and responsibilities on behalf of both Parties for the exploration and exploitation of the non-living natural resources of the sea-bed and subsoil in the overlapping area' as well as responsibility for the 'development, control and administration of the joint development area'[1265]. Petroleum, natural gas and 'other mineral deposit[s] of whatever character' are specifically mentioned only in the context of natural resources that might lie within and then extend beyond the Joint Development Area into areas of individual jurisdiction, in which case the parties agreed to communicate and attempt to reach agreement on exploitation.[1266]

In 1990, after more than a decade of negotiations to bring specificity to the general provisions of the 1979 memorandum of understanding, Malaysia and Thailand signed an agreement clarifying their rights and duties in the Joint Development Area and the role of the Joint Authority.[1267] The scope of the agreement still extended to all natural resources in the seabed and subsoil of

[1260] Miyoshi 1999 (n 1105) 13
[1261] 1979 Malaysia-Thailand MOU (n 1106)
[1262] ibid art I
[1263] ibid art III
[1264] ibid art III(1)
[1265] ibid art III(2)
[1266] ibid art III(6)
[1267] Agreement Between The Government Of Malaysia And The Government Of The Kingdom Of Thailand On The Constitution And Other Matters Relating To The Establishment Of The Malaysia-Thailand Joint Authority (adopted 30 May 1990) (1990 Malaysia-Thailand Agreement)

the Joint Development Area[1268], but petroleum merited special mention among the natural resources, with 'petroleum' being defined as including 'any mineral oil' and natural gas[1269]. This agreement conferred responsibilities on the Joint Authority to determine its own internal procedures and 'to permit operations and to conclude transactions or contracts for or relating to the exploration and exploitation of the non-living natural resources in the Joint Development Area'.[1270] All costs and benefits from operations in the Joint Development Area were to be shared equally by the parties.[1271] The treaty makes no mention of environmental protection or pollution prevention or remediation.

In 1999 David Ong published an article in which he analyzed the history of the Malaysia-Thailand agreements.[1272] In his opinion, the ability of the parties to reach an understanding on joint development of offshore natural resources was enabled by the fact that Malaysia and Thailand are both founding members of ASEAN (the Association of Southeast Asia Nations) and thus had a long history of friendly relations and cooperation.[1273] However, there was a lengthy period between execution of the memorandum of understanding and the implementing agreement, which can be attributed to several factors. First, after 1979 both nations experienced a change in political parties who were in power, resulting in shifting governmental priorities.[1274] Secondly, the parties disagreed on the powers to be given to the Joint Authority and which legal structure to use for petroleum development, with Malaysia wanting to grant more autonomy to the Joint Authority than Thailand did.[1275] Malaysia also wanted to utilize a production-sharing arrangement, whereas Thailand preferred a taxation regime.[1276] Lastly, pre-existing concessions awarded by Thailand had to be

[1268] ibid art 2(1)
[1269] ibid art 2(2)
[1270] ibid art 7(2)(e). Specific additional responsibilities and guidelines for petroleum operations were also provided in art 7(2)(f) and (g) and art 8.
[1271] ibid art 9(1)
[1272] Ong 1999 (n 1078)
[1273] ibid 213
[1274] ibid 221
[1275] ibid 225
[1276] ibid 228

regulated. In the final 1990 agreement, the legal competence of the Joint Authority is relegated to commercial matters involving development, and it cannot make domestic or international agreements without prior consent of the parties.[1277] Regarding the structure for development of the shared resources, the parties opted for production sharing and agreed that duration of the production contracts would not exceed thirty-five years. In addition, the Joint Authority would receive a ten percent royalty, and all costs of production would be borne by the contractor.[1278]

4.3.7 Colombia, Jamaica and the Caribbean Sea

In 1993, a few years after Malaysia and Thailand finalized their arrangement for joint management of offshore natural resources, Colombia and Jamaica delimited their boundaries in the Caribbean Sea and included all natural resources within the scope of the final agreement.[1279] While by this point Colombia had reached maritime delimitation agreements with nearly all of its neighbors except Nicaragua, this treaty was Jamaica's first entry into the world of maritime delimitation agreements.[1280] The treaty begins by setting forth the coordinates of their agreed shared boundary and then includes a straddling deposit clause, that, according to Masahiro Miyoshi, represents a simplified unitization clause[1281]:

> Where hydrocarbon or natural gas deposits, or fields are found on both sides of the delimitation line established in article 1, they shall be exploited in a manner such that the distribution of the volumes of the resource extracted from said deposits or fields is proportional to the volume of the same which is correspondingly found on each side of the line.[1282]

[1277] ibid 233
[1278] 1990 Malaysia-Thailand Agreement (n 1267) art 8
[1279] 1993 Jamaica-Colombia Treaty (n 1109)
[1280] Miyoshi 1999 (n 1104) 21
[1281] ibid 22
[1282] 1993 Jamaica-Colombia Treaty (n 1109) art 2

After thus determining a boundary and providing for treatment of straddling hydrocarbon and natural gas deposits, the parties then established a Joint Regime Area where the boundary between them is not delimited.[1283] In respect of Colombia's territorial claims, the Joint Regime Area excludes the cays of Serranilla at the western end and the cays of Bajo Nuevo on the eastern end, as well as a twelve-mile radius around the cays.[1284] The provisions regarding the Joint Regime Area include in their scope 'living and non-living resources'[1285], and the parties agree that 'exploration and exploitation of non-living resources . . . will be carried out on a joint basis'[1286]. A list of the activities that the parties may pursue in the Joint Regime Area is provided in the treaty:

> (a) Exploration and exploitation of the natural resources, whether living or non-living, of the waters superjacent to the seabed and the seabed and its subsoil, and other activities for the economic exploitation and exploration of the Joint Regime Area;
> (b) The establishment and use of artificial islands, installations and structures;
> (c) Marine scientific research;
> (d) The protection and preservation of the marine environment;
> (e) The conservation of living resources;
> (f) Such measures as are authorized by this Treaty, or as the Parties may otherwise agree for ensuring compliance with and enforcement of the regime established by this Treaty.[1287]

The treaty established a Joint Commission to 'elaborate the modalities for the implementation and the carrying out of the activities' listed above[1288], but

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[1283] ibid art 3
[1284] ibid art 3(1)(b-c). See also *Limits In The Seas No. 125: Jamaica's Maritime Claims And Boundaries* (US Department of State 2004) 8
[1285] 1993 Jamaica-Colombia Treaty (n 1109) art 3(1)
[1286] ibid art 3(3)
[1287] ibid art 3(2)
[1288] ibid art 4(1)

Colombia and Jamaica chose not to give the commission much power or authority, stating rather that the conclusions of the commission would be 'only recommendations' that would not be binding until adopted by the parties.[1289]

4.3.8 Senegal, Guinea-Bissau and Cape Roxo in the North Atlantic Ocean

In 1993 Senegal and Guinea-Bissau, two African nations with coastlines on the North Atlantic Ocean, entered into an agreement[1290] that anticipated a subsequent protocol to manage the resources in an Area beyond their twelve-mile territorial seas near Cape Roxo, which is on the border between the two nations. This agreement and its protocol have a long history that involves a 1960 delimitation by the respective colonial powers (France for Senegal and Portugal for Guinea), a 1989 arbitration through the auspices of the ICJ that affirmed the validity of the 1960 treaty, an objection by Guinea-Bissau to the arbitral award, and a 1991 decision by the ICJ that the parties should attempt to reach an agreement between themselves regarding their maritime boundary.[1291] Thus directed by the ICJ to resolve their differences 'as soon as possible'[1292], the two nations entered into an agreement in 1993 and a related protocol in 1995[1293], while still leaving their maritime boundaries undecided.

While the agreement and the protocol addressed both fisheries and non-living resources, the initial preliminary agreement included all resources from the continental shelf[1294], whereas the subsequent protocol executed two years later gave the Management and Cooperation Agency (Agency) authority over

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[1289] ibid art 4(3)
[1290] 1993 Sénégal-Guinea-Bissau Agreement (n 1116)
[1291] Sun Pyo Kim, *Maritime Delimitation and Interim Arrangements in North East Asia* (Martinus Nijhoff Publishers 2004) 137
[1292] *Case Concerning the Arbitral Award of 31 July 1989 (Guinea-Bissau v. Senegal)* (Judgment) (1991) ICJ Rep 53
[1293] Protocol to the Agreement Between the Republic of Guinea-Bissau and the Republic of Senegal Concerning the Organization and Operation of the Management and Cooperation Agency Established by the Agreement of 14 October 1993 (adopted 12 June 1995, entered into force 21 December 1995) 1903 UNTS 7 (1993 Senegal-Guinea-Bissau Protocol)
[1294] 1993 Sénégal-Guinea-Bissau Agreement (n 1116) art 2

fisheries and 'mining or petroleum activities'[1295] which are defined as 'mineral and petroleum (crude oil and natural gas) resources'.[1296] Therefore, any methane hydrates will be governed by the protocol, but offshore aquifers would be outside the scope of the arrangement since the initial agreement that included all resources was implemented by the protocol that addressed only minerals and petroleum. However, given that the original agreement has a duration of twenty years and is automatically renewable[1297], the two parties could certainly execute another protocol addressing offshore aquifers under the purview of the original agreement.

Senegal and Guinea-Bissau took a unique and more comprehensive approach to managing offshore natural resources that is worthy of closer scrutiny. First, the proportion of resources allocated to the states is different for fisheries and for non-living resources. Fishery resources are to be shared equally by the two nations, but non-living resources are apportioned with eighty-five percent going to Senegal and fifteen percent going to Guinea-Bissau, although the shares could be revised 'in the event of new discoveries'.[1298] Secondly, through an innovative and somewhat complex structure, the parties set up a corporation whose shares can be sold to private parties, with the two nations holding the majority of voting control.

The Agency has 'exclusive rights to mining and petroleum titles and to fishing in the Area'[1299] and is given broad responsibilities in the Protocol, including 'any activities with the aim of prospecting, exploring or exploiting the mineral or petroleum resources'.[1300] The Agency may meet its responsibilities through other organizations or through the publicly-held Enterprise[1301] and is composed

[1295] 1993 Senegal-Guinea-Bissau Protocol (n 1293) art 5(a)
[1296] ibid art 1.2
[1297] 1993 Senegal-Guinea-Bissau Agreement (n 1116) art 8
[1298] ibid, art 2
[1299] ibid art 6
[1300] 1993 Senegal-Guinea-Bissau Protocol (n 1293) art 5
[1301] ibid art 4

of two bodies: the High Authority and the Secretariat.[1302] The High Authority consists of heads of state or their designees [1303] and sets the general policy of the Agency[1304]. The President of the High Authority serves as the chairman of the Enterprise, and the High Authority appoints the Secretary-General of the Agency[1305], who also serves as the secretariat for the High Authority[1306].

The functions of the High Authority and the Secretary-General resemble other arrangements for joint development, but the Enterprise exhibits the creative nature of the Senegal-Guinea-Bissau arrangement. The Enterprise is designed to have a board of directors consisting of the representatives of the parties who also serve on the High Authority, shareholders and a Directorate-General who is 'responsible for the administrative, organizational and management functions of the Enterprise'.[1307] The Directorate-General is 'appointed by the Board of Directors on the proposal of the High Authority' and oversees three directorates, one each for fishing and mining, and a third for administrative and financial management.[1308] The High Authority, consisting of heads of state or their designees, controls two-thirds of the seats on the board of directors of the Enterprise as well as its chief executive officer.

The Enterprise can execute or authorize mining 'work or activities' and raise financing.[1309] The parties agreed to capitalize the Enterprise themselves at an initial USD 100,000, and two classes of shares were created. Class A shares comprise 51% of the total shares, were allocated by giving 67.5% to Senegal and 32.5% to Guinea-Bissau, and may not be transferred to any other party. The remaining Class B shares, on the other hand, may be sold to private parties, with the proceeds being distributed at 67.5% to Senegal and 32.5% to Guinea-Bissau. The Agency is also permitted to acquire revenues from taxes, fees, fines,

[1302] ibid art 7
[1303] ibid art 9
[1304] ibid art 10.1
[1305] ibid art 11.1
[1306] ibid art 9
[1307] ibid art 12
[1308] ibid
[1309] ibid art 6

royalties, levies, training and scientific activities, and profit from investments made by the Enterprise.[1310] Standard provisions addressing an obligation to cooperate[1311], security[1312], surveillance[1313], search and rescue[1314], and protection of the marine environment[1315] are also included in the protocol. On the condition that confidentiality is protected, the states agree to provide the Agency with all documentation they possess regarding the Area.[1316] Further, the parties and the Agency also agree to cooperate and coordinate 'directly or within international organizations on scientific, technical and technological research in the Area', and the Agency may conduct its own studies provided that any 'data, samples and/or results obtained in the course of such research' are shared with the parties upon their request.[1317]

The parties agree to 'cooperate with the Agency to prevent or minimize pollution or any other type of degradation in the marine environment resulting from resource prospecting, exploration and exploitation activities in the Area'[1318], and 'Companies shall be responsible for damage and expenditures incurred by pollution and any form of degradation of the marine environment arising out of their resource prospecting, exploration and exploitation activities in the Area in accordance with the rules and regulations in force'[1319].

In another interesting twist, '[t]he law applicable to mineral and petroleum resource prospecting, exploration and exploitation activities and to surveillance and scientific research in the mining and petroleum sphere shall be the law of Senegal', and '[t]he law applicable to fisheries resource prospecting, exploration and exploitation activities and to surveillance and scientific research in the

[1310] ibid art 15
[1311] ibid art 16
[1312] ibid art 17
[1313] ibid art 18
[1314] ibid art 19
[1315] ibid art 23
[1316] ibid art 21
[1317] ibid art 22
[1318] ibid art 23.1
[1319] ibid art 23.3

sphere of fisheries shall be the law of Guinea-Bissau'. In both cases, the applicable law is the law that existed on the date of signature of the protocol.[1320]

4.3.9 Oman, Pakistan and the Arabian Sea

The 2000 treaty between Oman and Pakistan served two purposes: it delimited the boundary in the Arabian Sea between two nations with opposing coasts and a long history of friendly relations, and it provided a straddle deposit clause.[1321] The delimitation provisions state that they are 'in conformity' with LOSC both in setting the baseline for their EEZs[1322] and in using the median line principle to determine the boundary between their respective EEZs.[1323] After acknowledging 'the sovereign rights of their respective States over the seabed, including the subsoil and superjacent waters'[1324], the two parties set forth their agreement on 'any geological petroleum structure, individual oil or gas field, mineral or other natural resources that cross the delimitation line'[1325]. In the event of 'partial or full exploitation . . . . on one side of the delimitation line by means of directional drilling from the other side', the parties will only undertake exploitation pursuant to a mutual agreement and will divide the resources 'according to the then prevailing rules and customs of international law as well as the principles of justice and equity'.[1326] Further, the parties agreed that neither of them will exploit any resources within one hundred twenty-five meters of either side of the delimitation line.[1327] The broad scope of the natural resources included in the treaty and the fact that any decision about future joint development is left to another agreement may be attributed to the close ties between the two neighbors. Indeed, in March 2015 the United Nations Commission on Limits of Continental Shelf (UNCLCS) awarded Pakistan an

[1320] ibid art 24
[1321] Muscat Agreement on the Delimitation of the Maritime Boundary between the Sultanate of Oman and the Islamic Republic of Pakistan (adopted 12 June 2000, entered into force 21 November 2000) UNTS registration #38455
[1322] ibid art 1
[1323] ibid art 2
[1324] ibid art 5
[1325] ibid art 6
[1326] ibid art 6(1)
[1327] ibid art 6(2)

additional 50,000 square kilometers of seabed based on the extension of its continental shelf to 350 miles[1328], and the Pakistani Adviser to Prime Minister on Foreign Affairs and National Security Sartaj Aziz thanked 'the brotherly country of Oman for its understanding and cooperation in the matter'.[1329]

4.3.10 Nigeria, São Tomé and Príncipe, and the Gulf of Guinea

After reaching an impasse in their attempt to delimit their maritime boundaries, Nigeria and its tiny island neighbors São Tomé and Príncipe signed a joint development agreement in 2001 consisting of fifty-three articles. The treaty focuses on petroleum but also includes within its scope all natural resources in the overlapping EEZs between the countries in the Gulf of Guinea.[1330]

The parties anticipated that the arrangements in the treaty would endure for a lengthy period of time, since the term of the agreement is forty-five years. A Joint Ministerial Council was established with 'overall responsibility for all matters relating to the exploration for and exploitation of the resources in the Zone'[1331], including the Joint Authority which is given authority over contractors, budgets and operations[1332]. The list of the Joint Authority's responsibilities is lengthy and broad[1333], and a board consisting of four executive directors who are assigned by the Council serves as a governing body for the Joint Authority.[1334] Among its responsibilities, the Joint Authority was also tasked with producing 'a regulatory and tax regime consistent with this Treaty, which shall be the applicable law relating to the exploration for and

[1328] UNCLCS, 'Summary Of Recommendations Of The Commission On The Limits Of The Continental Shelf In Regard To The Submission Made By The Islamic Republic Of Pakistan On 30 April 2009' (13 March 2015) para 34; UNCLCS, 'Progress of work in the Commission on the Limits of the Continental Shelf: Statement by the Chair' (20 April 2015) UN Doc CLCS/88, para 31
[1329] Baqir Sajjad Syed, 'Pakistan seabed territory grows by 50,000 square kilometres' (*DAWN*, March 21, 2015) https://www.dawn.com/news/1170986 accessed 10 January 2018
[1330] 2001 Nigeria-São Tomé and Príncipe Treaty (n 1117)
[1331] ibid art 8.1
[1332] ibid art 9
[1333] ibid art 9.6(a-t), 14, 19, 20, 21
[1334] ibid art 10

exploitation of petroleum in the Zone.'[1335] A Secretariat was created under the treaty to do the administrative work of the Council and the Authority.[1336] All of these activities are financed by the amounts collected by the Joint Authority from the development contractors[1337], and the remaining proceeds are distributed to the parties, with Nigeria receiving sixty percent and São Tomé and Príncipe receiving forty percent.[1338] The Joint Authority must also 'take all reasonable steps to ensure that development activities in the Zone do not cause or create any appreciable risk of causing pollution or other harm to the marine environment'[1339], and events such as large oil spillages and discharges must be reported to the Joint Authority immediately[1340].

According to Paul Michael Blyschak, the Nigeria-São Tomé and Príncipe treaty provides for unitization in three instances:

> The first provision for unitization applies where a reservoir straddles the joint development zone and the exclusive maritime area of either Nigeria or São Tomé. Where this is the case, the parties must endeavour to reach an agreement 'upon a fair and reasonable basis' for the optimal commercial unitized exploitation of the reservoir. The second is where a reservoir straddles two different contract areas within the joint development zone. Where this is the case the Council has authority to decide the appropriate resolution of the matter. The third is where a reservoir straddles the joint development zone and the exclusive maritime area of a third State. Where this is the case the Authority, subject to approval by the Council, is to consider negotiations with the third State with a view to reaching a definitive agreement regarding the exploitation of the reservoir.[1341]

[1335] ibid art 21.1.
[1336] ibid art 14.1
[1337] ibid arts 9.6(f), 17
[1338] ibid art 3.1
[1339] ibid art 38.1
[1340] ibid art 38.3
[1341] Blyschak (n 1097) 233

Should offshore fresh water aquifers be discovered in the joint development zone established under the treaty, an argument could be made that the management structure defined in the treaty would not apply to non-living resources other than petroleum and other minerals, since the term 'development activity' is defined to address only 'petroleum activity, fishing activity, all other activities for the development or exploitation of other mineral or living resources of the Zone'.[1342] However, Article 3 includes all resources in stating that '[w]ithin the Zone, there shall be joint control by the States Parties of the exploration for and exploitation of resources, aimed at achieving optimum commercial utilization'.[1343] In addition, Article 32 states that '[t]he Zone Plan may make provision for non-petroleum development activities within the Zone.'[1344] Conversely, by the terms of the treaty the water in methane hydrates would certainly fall under the scope of the agreement as a mineral. Therefore, one can make a strong argument that the treaty was drafted in such a way that the water in both offshore aquifers and methane hydrates would fall within the scope of its provisions, although development of offshore aquifers may present an opportunity to re-negotiate the existing management structure since the contracting power of the Joint Authority is limited to petroleum development activities.[1345]

4.3.11 Barbados, Guyana and the Caribbean Sea

In early December of 2003 the Caribbean island nation of Barbados entered into an agreement with the Latin American coastal nation of Guyana regarding management of the area where their EEZs overlap.[1346] Written nine years after

[1342] ibid art 1(7)
[1343] ibid art 3(1)
[1344] ibid art 32
[1345] ibid art 9.6
[1346] Exclusive Economic Zone Co-Operation Treaty between the Republic of Guyana and the State of Barbados concerning the Exercise of Jurisdiction in their Exclusive Economic Zones in the Area of Bilateral Overlap within Each of their Outer Limits and beyond the Outer Limits ofthe Exclusive Economic Zones of Other States (adopted 2 December 2003, entered into force 5 May 2004) 2277 UNTS 202, 56 Law of the Sea Bulletin 36 (2005)

the entry into force of LOSC, this agreement demonstrates the influence of LOSC through several laudatory references in the preamble and in later provisions. For example, the preamble states:

> EMPHASIZING the universal and unified character of the United Nations Convention on the Law of the Sea (hereinafter referred to as *the Convention)* and its fundamental importance for the maintenance and strengthening of international peace and security, as well as for the sustainable development of the oceans and seas . . . .
>
> RECOGNISING the relevance and applicability of paragraph 3 of Article 74 of the Convention, which establishes that, pending such delimitation, States, in a spirit of understanding and co-operation, shall make every effort to enter into provisional arrangements of a practical nature and, during this transitional period, not to jeopardize or hamper the reaching of the final agreement . . . [1347]

The first article also references LOSC when establishing a Co-operation Zone without a clearly delimited boundary line between the state-parties. The Co-operation Zone was intended

> for the exercise of joint jurisdiction, control, management, development, and exploration and exploitation of living and non-living natural resources, as well as all other rights and duties established in the Convention [LOSC], within the area over which a bilateral overlap occurs between their exclusive economic zones and beyond the outer limits of the exclusive economic zones of other States.[1348]

By its terms the treaty covers all 'living and non-living natural resources', thus including fisheries as well as offshore aquifers and methane hydrates.

[1347] ibid Preamble
[1348] ibid art 1(1)

The resource management mechanism does not establish a strong commission with broad authority. While the parties agree to 'exercise joint civil and administrative jurisdiction' within the Co-operation Zone[1349], any joint exercise of jurisdiction must be evidenced by an exchange of diplomatic notes[1350]. If no writing is agreed, then neither party may exercise jurisdiction.[1351] Guidelines for administering living natural resources and non-living natural resources are presented in different articles with provisions for a future Joint Fisheries License Agreement[1352] and a Joint Non-Living Resources Commission.[1353] The benefits of any non-living natural resources are to be shared equally[1354], while the straddle deposit clause provides that the benefits of any 'single geological structure or field of non-living natural resources . . . shall be apportioned between them based on unitisation arrangement'.[1355] Any scientific research or development activities within the Co-operation Zone can only take place pursuant to an express agreement between Barbados and Guyana[1356], and the results of any scientific surveys must be shared[1357]. Provisions regarding security[1358] and protection of the marine environment[1359] are also included.

4.3.12 Oman, Yemen and the Arabian Sea

In 2003, three years after the conclusion of its treaty with Pakistan and eleven days after the signature of the treaty between Barbados and Guyana, Oman entered into another maritime boundary delimitation agreement regarding the

[1349] ibid art 3(1)
[1350] ibid art 3(2)
[1351] ibid art 3(3)
[1352] ibid art 5(2)
[1353] ibid art 6(2)
[1354] ibid art 6(5)
[1355] ibid art 6(7)
[1356] ibid art 6(8)
[1357] ibid art 6(9)
[1358] ibid art 7
[1359] ibid art 8

Arabian Sea, this time with its adjacent neighbor Yemen.[1360] In some respects, this agreement mirrors Oman's agreement with Pakistan but with some important differences. Rather than simply delimit the EEZ as it did with Pakistan, in this treaty Oman set forth the coordinates of the maritime boundary delimitation of the territorial sea, the EEZ and the outer continental shelf. The reason for this difference becomes clear by consulting a map – Oman and Pakistan have opposing coastlines whose intersection is outside the territorial sea of each nation. In contrast, Oman and Yemen have adjacent coastlines, and therefore the boundary lines separating the territorial sea, the EEZ and the continental shelf could all be in dispute. The treaty goes on to declare that the boundary lines shall be final and that 'neither Party shall have the right to seek any extension of the continental shelf across the boundary of the other Party'.[1361]

Each state recognizes the other's 'sovereign rights and jurisdiction over its boundary for the purposes of exploration, exploitation, conservation and management of the natural resources, both living and non-living, of the seabed, subsoil and the superadjacent waters'.[1362] However, while the treaty once again prohibits exploitation for one hundred twenty-five meters on either side of the delimited boundary, it does not indicate how the parties will divide the resources, simply stating instead that they 'shall do their utmost to reach agreement as to the manner in which the operations on both sides of the boundary line may be coordinated and unified'.[1363] This provision would seem to guide the parties toward a unitization and joint development arrangements. Finally, the treaty provides that the parties 'may agree to form a joint commission . . . . to prepare annexes regulating all matters relevant to this Agreement'.[1364] While this treaty includes all offshore natural resources within

[1360] Agreement on the delimitation of the maritime boundary between the Sultanate of Oman and the Republic of Yemen (adopted 14 December 2003, entered into force 3 July 2004) 2309 UNTS 249
[1361] ibid art 1
[1362] ibid art 3
[1363] ibid art 4
[1364] ibid art 6

its purview, its only firm commitments revolve around the delimited boundaries and the parties' sovereign rights. Everything else is left to a future discussion, and there are no provisions regarding environmental protection.

4.3.13 Seychelles, Mauritius and the Indian Ocean

Seychelles and Mauritius, two island nations in the Indian Ocean who are both parties to LOSC, entered into several agreements in an effort to secure a final solution regarding both their maritime delimitation and their joint approach to development of natural resources. In 2008, the two nations agreed that the boundary line between their respective EEZs would be determined by the equidistant method, 'considered in this particular case as an equitable solution in conformity with international law'.[1365] Meanwhile, in that same year Seychelles and Mauritius filed an application with the United Nations Commission for Limits of the Continental Shelf ('UNCLCS') to formalize recognition of their outer continental shelves beyond the two hundred-mile EEZ in the region of the Mascarene Plateau.[1366] Three years later in 2011, the UNCLCS adopted final recommendations, recognizing the validity of the separate claims of Seychelles and Mauritius to extension of their territories onto the shared continental shelf but without delimiting the boundary between them.[1367] With the coordinates of the extended continental shelf of the Mascarene Plateau thus clarified, the parties turned their attention to defining how joint development of offshore resources would be managed. David Ong notes that the resulting treaties represent the first bilateral agreements

[1365] Agreement between the Government of the Republic of Mauritius and the Government of the Republic of Seychelles on the Delimitation of the Exclusive Economic Zone between the Two States (adopted 29 July 2008, entered into force 19 November 2008) 69 Law of the Sea Bulletin 106, art 1

[1366] UNCLCS, 'Republic of Mauritius and Republic of Seychells Joint Submission to the Commission on the Limits of the Continental Shelf concerning the Mascarene Plateau Region: Executive Summary (revised)' (March 2010) SMS-ES-DOC_Rev

[1367] UNCLCS, 'Summary of the Recommendations of the Commission on the Limits of the Continental Shelf in Regard to the Joint Submission Made By Mauritius and Seychelles Concerning the Mascarene Plateau Region on 1 December 2008' (30 March 2011)

governing overlapping claims to the outer continental shelf beyond two hundred nautical miles.[1368]

Seychelles and Mauritius took an unusual approach to joint development by entering into two agreements on the same day in March 2012, one declaring that they would jointly exercise sovereign rights over the Joint Zone[1369] and one addressing joint development in the Joint Zone[1370]. The treaty providing for joint exercise of sovereign rights is very short – a mere four articles. The first article states simply that the 'Contracting Parties shall exercise sovereign rights jointly for the purpose of exploring the continental shelf and exploiting its natural resources . . . in the Joint Zone', [1371] the second article delineates the map coordinates of the Joint Zone, the third article reserves rights regarding any future delimitation, and the fourth article provides requirements for entry into force.

The treaty regarding cooperative management of the Joint Management Area (JMA) is much more robust, consisting of twenty-three articles and four annexes. To begin, the treaty establishes that its scope extends to all natural resources by declaring that the parties will 'jointly control, manage and facilitate the exploration of the continental shelf' and 'the conservation, development and exploitation of its natural resources.'[1372] Natural resources are defined as 'mineral, petroleum and other non-living resources of the seabed

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[1368] David Ong, 'Delimitation of the outer continental shelf and prospects for revenue sharing between states and the international community' in Jill Barrett and Robert Barnes (eds), *Law of the Sea: UNCLOS as a Living Treaty* (British Institute of International and Comparative Law 2016) 82

[1369] Treaty Concerning the Joint Exercise of Sovereign Rights Over the Continental Shelf in the Mascarene Plateau Region between the Government of the Republic of Mauritius and the Government of the Republic of Seychelles (adopted 13 March 2012, entered into force 18 June 2012) UNTS registration #49782, 79 Law of the Sea Bulletin 26 (2012 Mauritius-Seychelles Sovereign Rights Agreement)

[1370] Treaty Concerning the Joint Management of the Continental Shelf in the Mascarene Plateau Region between the Government of the Republic of Mauritius and the Government of the Republic of Seychelles (adopted 13 March 2012, entered into force 18 June 2012), 79 Law of the Sea Bulletin 41 (2012 Mauritius-Seychelles Joint Management Agreement)

[1371] 2012 Mauritius-Seychelles Sovereign Rights Agreement (n 1369) art 1

[1372] 2012 Mauritius-Seychelles Joint Management Agreement (n 1370) art 3(b)

and continental shelf together with living organisms' that are sedentary[1373], and, unlike the Nigeria- São Tomé and Príncipe treaty, the term 'natural resource activity' is used throughout this treaty to refer to development activities for all natural resources. Offshore aquifers and methane hydrates would therefore both fall within the scope of the agreement.

Similar to the agreement between Nigeria and São Tomé and Príncipe, the joint management agreement between Seychelles and Mauritius has a three-tier governmental structure, but with functions that are different from the Nigeria-São Tomé and Príncipe structure. The Ministerial Council is tasked with 'consider[ing] any matter relating to the operation of this Treaty' that is referred to it by the parties or by the Joint Commission.[1374] The Joint Commission 'establish[es] policies and regulations relating to petroleum and other natural resource activities' and 'oversee[s] the work of the [Designated] Authority'.[1375] The Authority is responsible for 'the day-to-day regulation and management of natural resource activities' in the JMA.[1376] The parties agree to share equally both revenue from natural resource activities and costs of the Authority.[1377] However, a 'reservoir of petroleum or unitary mineral deposit' that straddles the JMA and the EEZ of either party or both parties 'will be treated as a single entity for exploration, development and management purposes', and the parties will determine an 'equitable sharing of revenue'[1378], which may or may not be equal[1379]. Therefore, the straddle deposit clause in this treaty mandates unitization of a petroleum or mineral deposit, and provides for both equitable and equal sharing of revenues, depending on the location of the natural resource. Subsequent articles address protection of the environment and biodiversity, employees, taxes, customs, and security. In

[1373] ibid art 1(l)
[1374] ibid art 4(b)(ii)
[1375] ibid art 4(c)(i). A 'non-exhaustive list' of the duties of the Joint Commission is provided in Annex C of the treaty.
[1376] ibid art 4(d)(iii). A 'non-exhaustive list' of the duties of the Authority is provided in Annex D of the treaty.
[1377] ibid art 5
[1378] ibid art 10
[1379] ibid art 5(c)

addition, the parties agree to cooperate in using the precautionary principle 'to secure seabed biodiversity and prevent pollution and other risks of harm to the environment arising from, or connected with, natural resource activities' in the Joint Management Zone.[1380]

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A review of the treaties described in this section of the chapter and in the previous section reveals the growing acceptance and implementation of several key structural components when states wish to exploit and market valuable non-living natural resources, regardless of whether they are hydrocarbons, minerals or other natural resources.. Consistent with established principles governing land-based freshwater and with dictates from LOSC and the ICJ, nations seek mechanisms for cooperation. Treaties generally define the area that will be the subject of joint development, and they also generally create a joint management commission that has varying degrees of power and autonomy, depending on the nature of the relationship between the states.[1381] Having a clearly a delimited boundary line has not proven to be a requirement for cooperation in confirming and exploiting hydrocarbon reserves, and un-delimited maritime areas have benefitted from coordinated development. Regardless of whether the maritime boundary has been delimited or not, in order to conserve financial, technical and human assets, states have often adopted a unitized method of development either by jointly selecting a single operator for exploration and exploitation and/or by obliging their separate concessionaries to cooperate.

The final design of a structure to manage offshore natural resources often depends on the facts and circumstances of each unique situation and the history and relationship between the treaty parties. Future treaties for development of

[1380] ibid art 12(a)

[1381] As described in Chapter 3.4.4, the mechanism of creating a joint management structure has also been employed in each of the four ratified treaties for management of land-based transboundary aquifers.

offshore freshwater will doubtless adopt some of the provisions that have featured in other treaties, such as defining the area of cooperation, utilizing a unitization structure and establishing a joint committee. One clear pattern can be identified in treaties for offshore hydrocarbon development – nations willingly accept limitations on sovereignty and accept to cooperate in order to maximize the commercial benefits that can be obtained from a natural resource.

4.4 Environmental impact of offshore development

Development of natural resources in the seabed results in environmental impacts both to the seabed and to the surrounding flora and fauna. After seismic testing has located the reservoir and estimated its size, the drilling process begins, first to explore and then to extract the buried treasures. Each of these stages presents its signature set of effects on the seabed and marine ecosystems. Just as the desire to develop transboundary hydrocarbon reserves caused governing structures such as unitization and joint development agreements to emerge, so also a separate body of treaties grew from efforts to protect the marine environment from the impacts of exploration and extraction of hydrocarbons when the damage caused by the offshore activities became clear. In negotiating and concluding these treaties, states accepted additional limitations on their sovereignty in order to engage in proactive protection of the marine environment. This section of Chapter 4 will describe the environmental concerns that arise at each stage of development, and the reader is referred to Chapter 2 for a description of the treaties that protect the marine environment.

The first step in determining the location of a hydrocarbon reserve involves conducting seismic surveys of the seabed through the use of equipment such as air gun arrays that emit high-pressure air bubbles and low-frequency, high-power transducers with wide-beam angles (also called deep-water multibeam sonar systems).[1382] The soundwaves from these tests have been detected up to

[1382] Peter T Harris, 'Anthropogenic Threats to Benthic Habitats' in Peter T Harris and Elaine K Baker (eds), *Seafloor Geomorphology as Benthic Habitat* (Elsevier 2012) 44

four thousand kilometers from their source[1383], and as a result the impact of exploratory efforts can be quite extensive. The sound and light produced by these techniques have been observed to affect and displace marine denizens from small invertebrates to larger marine fauna such as cetaceans, seals and fish.[1384] One example of the power of seismic impulses is found in scallop larvae, where physical deformations and significant delays in development have been recorded.[1385]

Once a promising geological structure has been located, several holes are drilled to confirm the presence and volume of oil or gas before extraction wells are drilled into the reservoir.[1386] Exploratory holes and extraction wells have similar environmental impacts through the sediment and crushed rock brought to the surface (known as cuttings) and through the fluids used in the drilling process (known as mud).[1387] Brine water, called produced water, always accompanies oil and gas formations and its dispersion may have environmental impacts such as behavioral changes in local fauna.[1388] The volume of produced water to oil is three to one, and, due to the contaminating properties of produced water, its dispersion is highly regulated while techniques are being developed to treat and recycle it for use in agriculture and industry.[1389] While briny produced water will not accompany offshore aquifers, drilling for the freshwater in offshore aquifers will have other effects similar to those of hydrocarbon exploration and exploitation. Development of methane hydrates will have different environmental impacts, which will be addressed below.

[1383] Erik E Cordes and others, 'Environmental Impact of the Deep-Water Oil and Gas Industry' (2018) 32 Renewable Resources Journal 8, 8 (Cordes and others 2018)
[1384] Harris (n 1382) 44-5
[1385] Cordes and others 2018 (n 1383) 9
[1386] Charles A Menzie, 'The environmental implications of offshore oil and gas activities' (1982) 16 Environmental Science and Technology 454, 454; Constantinos Yiallourides, 'Protecting and preserving the marine environment in disputed areas: seismic noise and provisional measures of protection' (2018) 36 Journal of Energy & Natural Resources Law 141, 147-150
[1387] Menzie (n 1386) 454; Michael D Paine and others, 'Effects of the Terra Nova offshore oil development on benthic macro-invertebrates over 10 years of development drilling on the Grand Banks of Newfoundland, Canada' (2014) 110 Deep-Sea Research II 38, 39
[1388] Menzie (n 1386) 461
[1389] Fakhru'l-Razi Ahmadun and others, 'Review of technologies for oil and gas produced water treatment' (2009) 170 Journal of Hazardous Materials 530

The cuttings from first fifty to one hundred fifty feet of a well are deposited on the seabed around the drill site and can drift for more than two kilometers from the site.[1390] While the initial cuttings may not be toxic, they can be lethal to the benthic organisms and microorganisms that are buried beneath the sediment and crushed rock.[1391] The cuttings decrease as the well bores more deeply into the crust of the earth[1392], and at that point the cuttings accompany the mud to the drill rig and are filtered out as part of the process of cleaning the mud for reuse[1393]. The toxicity of the cuttings that have been in the mud solution prior to being returned to the seabed depends on the type of solution used for the mud.

Mud is a critical drilling fluid that serves a number of purposes, such as 'cooling and lubricating the drill bit and string, removing and transporting cuttings from the hole to the surface, and controlling formation pressures'.[1394] Drill muds come in three types: oil-based mud (OBM) using either diesel or low-aromatic mineral oil, synthetic-based mud (SBM) using ethers, esters, olephins or vegetable oils, and water-based mud (WBM) using seawater.[1395] All drilling muds contain metals such as barite that could be toxic in high concentrations.[1396] OBM was the drilling mud most utilized until the 1990s, when it was phased out due to its toxic effects on marine fauna.[1397] SBM cuttings carry potentially greater environmental impacts than WBMs and the cuttings that accompany WBM due to a 'high concentration of biodegradable

[1390] Erik E Cordes and others, 'Environmental Impacts of the Deep-Water Oil and Gas Industry: A Review to Guide Management Strategies' (2016) 4:58 Frontiers of Environmental Science 1, 1 (Cordes and others 2016)
[1391] Paine and others (n 1387) 39; Cordes and others 2016 (n 1390) 470
[1392] Menzie (n 1386) 456
[1393] Paine and others (n 1387) 39
[1394] Menzie (n 1386) 454
[1395] Torgeir Bakke, 'Environmental impacts of produced water and drilling waste discharges from the Norwegian offshore petroleum industry' (2013) 92 Marine Environmental Research 154, 161; Paine and others (n 1387) 39
[1396] Paine and others (n 1387) 39
[1397] Bakke (n 1395) 154-5

synthetic organic chemicals'[1398] that negatively affect available oxygen in the sediments[1399]. Recent studies of discharges with WBM cuttings have indicated low toxic effects[1400], although artificially deposited sediments continue to risk burying benthic organisms and microfauna. Currently, WBM is the drilling fluid of choice, but seabeds such as those in the North Sea still carry the legacy of decades of discharges of OBM and OBM cuttings.[1401]

Infrastructure installations have their own impacts on the surrounding environment. Within a radius of approximately one hundred meters from the installations, anchors and chains are placed on the seafloor and sediment is suspended in the water column.[1402] In addition, pipelines may be placed on the seabed to transport the hydrocarbons.[1403] Noise and artificial lights are present for as long as the platform is operational.

Seabed mining is more harmful to benthic organisms than to more mobile species, although the loss of benthic organisms can reduce food sources for mobile species.[1404] Detrimental impacts from seabed mining include habitat loss, sediment plumes, smothering and burying of seabed inhabitants, clogging of feeding mechanisms and changes in vital sediment characteristics.[1405] Because of the colder temperatures and slower metabolic rates of deep seabed denizens, recovery of those species from environmental degradation takes much longer than shallow water species and can require decades.[1406] Further, seabed sediments contain organic contaminants and heavy metals that are

[1398] Paine and others (n 1387) 39
[1399] Bakke (n 1395) 161
[1400] ibid 162
[1401] ibid 161-2
[1402] Cordes and others 2016 (n 1390) 1
[1403] ibid 6
[1404] Laura Kaikkonena and others, 'Assessing the impacts of seabed mineral extraction in the deep sea and T coastal marine environments: Current methods and recommendations for environmental risk assessment' (2018) 135 Marine Pollution Bulletin 1183, 1188
[1405] JI Ellis and others, 'Environmental management frameworks for offshore mining: the New Zealand approach' (2017) 84 Marine Policy 178, 181
[1406] Cordes and others 2016 (n 1390) 2; Kaikkonena and others (n 1404) 1190

released by deep seabed mining and can linger and be transported in the water column.[1407]

While drilling methods and fluids designed and tested over time for offshore hydrocarbons will doubtless be utilized for offshore aquifers, methane hydrates are still in the early stages of being researched and harvesting them from the ocean floor may require newer techniques that have not yet been perfected. In fact, current estimates predict that full-scale mining of methane hydrates will not be possible until 2030.[1408] Methane hydrates are particularly fragile due to the rapid dissociation they experience when removed from their low-temperature/high-to-medium-pressure conditions[1409], so the recovery techniques will have to protect the integrity of the clathrate. However, the hydrates are present on the seafloor and up to a kilometer beneath the seafloor, so there can be little doubt that the recovery techniques will disturb the seabed.

In addition to disturbance of the seabed floor and sediment that would accompany any mining activity[1410], dissociation of methane hydrates could contribute to greenhouse gasses if the methane succeeds in passing through the water column to the atmosphere[1411]. Carolyn Ruppel and John Kessler argue, however, that if methane is released deep in the ocean, only a minimal amount of the gas will rise to the water surface and escape into the atmosphere 'owing to strong microbial sinks and the tendency of methane to remain deeper in the water column'.[1412] An additional concern regarding development of methane hydrates arises from their frozen water component, whose melting during

[1407] Kaikkonena and others (n 1404) 1186
[1408] Martha Henriques, 'Why 'flammable ice' could be the future of energy' (*BBC,* 23 November 2018) http://www.bbc.com/future/story/20181119-why-flammable-ice-could-be-the-future-of-energy accessed 24 November 2018
[1409] Carolyn D Ruppel and John D Kessler, 'The interaction of climate change and methane hydrates' (2017) 55 Reviews of Geophysics 126, 126
[1410] Harris (n 1382) 47
[1411] Ruppel and Kessler (n 1409) 127-8
[1412] ibid 155-6

disassociation would release liquid water into the sediment that could destabilize steeper slopes and potentially lead to tsunamis.[1413]

4.5 Conclusion

Freshwater and hydrocarbons are obviously different natural resources, but when located offshore they share important similarities. Freshwater in offshore aquifers is in a liquid state, similar to oil and gas in seabed formations, and methane hydrates are being investigated for their hydrocarbon potential, with their freshwater components being a minor secondary consideration. Regardless of whether the offshore freshwater is found in aquifers or in methane hydrates, maritime delimitations and treaties addressing offshore transboundary natural resources will be influential and perhaps controlling when development begins. Therefore, an understanding of the legal structures, judicial decisions and treaties that govern offshore hydrocarbon development is critical to predicting how nations might approach governance of offshore freshwater resources and to what extent those nations might be willing to limit their sovereignty over shared resources to achieve cooperative development. To that end, this chapter has provided a summary of the various legal influences on offshore hydrocarbon development that might be adapted – or even adopted -- for transboundary offshore freshwater resources.

Due to the enormous profits that have accrued to the industry, offshore hydrocarbon development has benefited from much time, attention and financial investment for those nations fortunate enough to have oil and/or gas lying under their seabeds. Inspired by guidance from the ICJ and prompted by a need for financially and technically efficient methods of developing offshore reserves, the hydrocarbon industry adopted governance regimes that embraced the basic principles of international water law. Through mechanisms such as unitization and joint development agreements, states sharing transboundary

[1413] Henriques (n 1408)

reservoirs of oil and gas implemented a process for equitable and reasonable utilization of the resource through allocating the revenues and expenses of exploration and exploitation. By appointing a single operator to conduct all activities, states protected against significant harm to the resource. Further, the joint commissions established in many of the treaties reviewed in this chapter ensured data-sharing and notification of planned measures. Those treaties indicate a willingness of states to voluntarily limit exercise of total sovereignty in exchange for better access to and financial return from a valuable resource. The scope of the power granted to joint commissions depends on the history and course of dealing between the states involved, but the trend is toward greater power, as seen in the 2012 agreement between the Seychelles and Mauritius.

Not all offshore transboundary freshwater resources will be found in geographical areas already subject to bilateral and multilateral treaties. Should the relevant states decide that their needs would best be served by commemorating their collaboration in an agreement, the nature and extent of the resulting provisions will reflect whether currently accepted structures will apply to new circumstances. Whether treaties for co-development of transboundary offshore freshwater reserves will feature provisions not currently found in hydrocarbon treaties will probably depend on whether additional risks arise.

In addition to transboundary concerns, states wishing to develop offshore freshwater will have to navigate the growing number of laws and regulations that have been enacted to protect the marine environment in domestic and shared seabeds. The environmental impacts of offshore drilling and mineral extraction have been described in this chapter, while Chapter 2.2 presented the array of global and regional conventions and international laws that guide states on protecting the marine environment from those impacts. Many of the states that have entered into bilateral agreements are also parties to one or more treaties in which they have agreed to take measures to study the impacts

of development through issuance of environmental impact assessments and to preserve endangered species and critical biodiversity. Ultimately, each state must determine for itself how to strike a balance between developing a valuable resource and protecting its marine ecosystems.

In a future where land-based freshwater is in short supply and the critical value and essential nature of freshwater is appreciated, the next series of treaties for offshore natural resources may well focus on freshwater. Those treaties with either offshore transboundary aquifers or offshore transboundary methane hydrates in their scope may be renegotiated or re-interpreted.

CHAPTER 5

GOVERNANCE OF OFFSHORE FRESHWATER AND EMERGING TRENDS

INTRODUCTION

Until recently, the legal principles that would govern offshore freshwater resources in seabed aquifers and in methane hydrates have not been clearly stated nor even widely discussed.[1414] However, should states choose to follow the governance principles that apply to other seabed natural resources, the advocacy and success of certain legal arguments can be safely predicted. One can expect that, when considering how to apportion rights over offshore freshwater reserves, political boundaries will determine sovereignty and sovereign rights to possess, exploit and trade in those resources lying within national jurisdictions. The first part of this chapter will outline the governance regime that would be imposed on offshore freshwater reserves should they be developed in the near future. As an illustration of the principles that have been presented in the previous chapters, the first part of this chapter will explore the various fact scenarios that are represented in Figure 1 below.

Yet, wide acceptance and implementation of global principles and structures does not always guarantee their ultimate effectiveness or wisdom, and contemporary allocation regimes for natural resources have contributed to inequities in distribution[1415] and to ecosystem degradation[1416]. When discussing distribution of the last cache of vital freshwater, innovative theories

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[1414] The author's 2016 monograph was the first publication on the topic of governance of offshore aquifers. Renee Martin-Nagle, 'Transboundary Offshore Aquifers: A Search for a Governance Regime" (2016) 1.2 International Water Law Journal. A subsequent article proposed a regional governance regime for African offshore aquifers. Nicholas N Kimani, 'The African Union's role in the governance of offshore freshwater aquifers' (2016) 31 The International Journal of Marine and Coastal Law 620

[1415] TIE Veldkamp and others, 'Water scarcity hotspots travel downstream due to human interventions in the 20th and 21st century' (2017) Nature Communication, DOI: 10.1038/ncomms15697 <https://www.nature.com/articles/ncomms15697.pdf> accessed 27 December 2017

[1416] Maite Arroita and others, 'Water abstraction impacts stream ecosystem functioning via wetted-channel contraction' (2017) 62 Freshwater Biology 243

and approaches must be considered in order to foster a climate that will fertilize formation and acceptance of alternative allocation mechanisms. Therefore, the second part of this chapter will explore some emerging theories that support alternate viewpoints regarding ownership and distribution of freshwater, including the human right to water, benefit-sharing, a global commons and post-sovereign governance.

5.1 Governance of offshore freshwater under current principles

In spite of the complexity produced by overlapping legal regimes, predicting the overall structure of a governance regime for offshore freshwater resources under current legal principles is fairly straightforward.

5.1.2 Governance of domestic resources

As explained in Chapter 1, seabed aquifers and methane hydrates will be found within the continental shelf areas. Thus far, offshore freshwater aquifers have not been found further than eighty nautical miles from the shoreline, and, due to the dynamics of seawater intrusion into geological formations, scientists do not expect freshwater aquifers to exist outside of the two-hundred nautical mile EEZ Seabed. On the other hand, methane hydrates will certainly be found in both the EEZ Seabed and the outer continental shelf (OCS). Methane hydrates are not expected to form in the deep seabed beyond the limits of the continental shelf, but they could fall under the jurisdiction of the Area if a state has not formalized its claim to its OCS.

As described in Chapter 2, customary law grants sovereignty over seabed resources in the continental shelf to coastal states, and that customary law is codified by Part VI of LOSC.[1417] If offshore freshwater resources are located within the territorial sea, the EEZ Seabed or the OCS of a single nation, that nation would have exclusive sovereign rights to explore and exploit those

[1417] United Nations Convention on the Law of the Sea (adopted 10 December 1982, entered into force 16 November 1994) 1833 UNTS 897 (LOSC)

resources. Regarding methane hydrates within the OCS of a single state, in accordance with Article 82 of LOSC that state will still have exclusive rights to explore and exploit the resource, but the coastal state must 'make payments or contributions in kind in respect of the exploitation of the non-living resources'[1418] to the International Seabed Authority (ISA). Beginning in the fifth year of production and increasing by one percent per annum until the twelfth year, a maximum of seven percent of 'the value or volume of production at the site'[1419] must be allocated to developing states 'on the basis of equitable sharing criteria'[1420]. As of this writing, no resources have been extracted from the OCS[1421], and therefore no payments have yet been made to the ISA for resources exploited in the extended continental shelf, leaving a vacuum of practice and jurisprudence on the interpretation and implementation of Article 82's 'equitable sharing criteria'.

Therefore, a state that is a LOSC party can be certain that offshore freshwater reserves that are located solely within its territorial sea, its EEZ Seabed or its OCS are within its exclusive jurisdiction and control, and any development activities will fall under its domestic laws. Coastal states that are not parties to LOSC will still have exclusive rights to offshore freshwater in their continental shelves, but the benefit-sharing requirements for resources in the OCS may not apply unless they are deemed to be customary law.

For the most part, states are free to regulate development of seabed natural resources as they wish within their own territories. However, as described in Chapter 2, states still have international and regional obligations to protect the environment. Part XII of LOSC requires states to protect and preserve the marine environment during exploitation and to prevent and control pollution.

[1418] ibid art 82(1)
[1419] ibid art 82(2)
[1420] ibid art 82(4)
[1421] However, the technology for extracting seabed minerals in domestic EEZ Seabeds is progressing. Katy Scott, 'Diamonds in the deep: How gems are mined from the bottom of the ocean' (*CNN*, 4 September 2018) <https://edition.cnn.com/2018/09/03/africa/marine-diamond-mining-namibia/index.html> accessed 5 September 2018

Regional treaties also have varying requirements to protect the environment in domestic waters, with European treaties for the Mediterranean, North and Baltic Seas being the most stringent. In addition, the Convention on Biological Diversity (CBD) places further obligations on states to conserve biodiversity. States may also be subject to restrictions from the shipping and fishery sectors that could have indirect impacts on development of offshore freshwater resources. Any state wishing to commence development of offshore freshwater will have to be cognizant of the wide array of environmental protection obligations that apply even in their own sovereign territories. These obligations may also include domestic laws and regulations that are beyond the scope of this thesis.

5.1.3 Governance of transboundary resources

While jurisdiction and control over resources within the EEZ Seabed and the OCS of a single coastal nation have been assigned to that state, LOSC is silent regarding transboundary seabed resources. As detailed in Chapter 4, this uncertainty led nations to seek guidance from the International Court of Justice (ICJ) regarding delimitation of marine boundaries, beginning with the *North Sea Continental Shelf Cases*[1422], a dispute that arose over development of transboundary hydrocarbons. Rather than draw boundary lines for the disputing states, the ICJ opined that 'delimitation must be the object of agreement between the States concerned, and that such agreement must be arrived at in accordance with equitable principles'.[1423] The court noted that one of the 'factual elements' to be considered in achieving an equitable solution is protection of the unity of the deposit.[1424] From that scant direction, nations anxious to transform offshore hydrocarbons into on-shore wealth adopted unitization and joint development agreements as their preferred methods of collaborative exploitation. Chapter 4 describes how nations whose maritime

[1422] *North Sea Continental Shelf Cases (Federal Republic of Germany/Denmark; Federal Republic of Germany/Netherlands)* (Judgment) (1969) ICJ Rep 1969 (*North Sea Continental Shelf Cases*)
[1423] ibid para 85
[1424] ibid para 97

jurisdictions included confirmed or potential seabed hydrocarbons entered into agreements with neighboring states to explore and exploit shared hydrocarbon deposits in a cooperative manner. The terms of those treaties and agreements vary from case to case, but all of them contain provisions regarding appointment of jointly nominated operators who would work on behalf of the relevant nations and provisions allocating costs and profits. Even the absence of clear, delimited maritime boundaries did not prevent states from entering into agreements for joint development of natural resources that straddled their territories. Since the nations freely entered into these legally binding arrangements, one could argue that the agreements reflected what the nations viewed as an equitable approach to development of their shared resource, although the effects of economic hegemony cannot be dismissed.

Thus, when considering a governance regime for transboundary offshore freshwater resources under contemporary legal, political and economic structures, the precedential value of the legal regime for development of offshore hydrocarbons that is described in Chapter 4 must be consulted. With regard to transboundary offshore aquifers, the fresh to slightly brackish water sequestered therein carries many physical similarities to offshore hydrocarbon reserves. Both seabed freshwater and offshore oil and gas exist in liquid form within geological formations that can extend across national boundaries. The technologies for exploration, extraction and transportation of offshore freshwater will doubtless be similar to those used for offshore hydrocarbons -- a combination of techniques will be employed to locate the reserves, and the water will be extracted through drilling or pipelines prior to being transported to treatment facilities that would prepare the water for use.[1425] All of these steps will require significant capital investment and entail ongoing operational expenses. Hence, one can expect that, where transboundary freshwater aquifers exist, nations will follow the economic pattern widely used in

[1425] For an explanation of technology utilized to locate, develop and transport offshore hydrocarbon, see generally James G Speigh, *Handbook of Offshore Oil and Gas Operations* (Elsevier 2015).

development of transboundary offshore hydrocarbons, whereby those nations collaborate through joint development agreements to reduce costs by selecting a single operator for exploration and extraction, with their respective shares of costs and profits being pre-agreed. Treaties broadly addressing shared natural resources would include both offshore freshwater aquifers and methane hydrates in their scope, but, as shown in Chapter 4, fewer than a dozen such treaties have been concluded. Given the critical nature of freshwater, one can anticipate that, when offshore freshwater aquifers are developed, a new series of treaties will be negotiated to provide for collaborative exploration and exploitation of any transboundary reserves.

Development of transboundary offshore methane hydrates will doubtless also involve joint development agreements, but the analysis is slightly different from that for transboundary offshore aquifers. In spite of the fact that methane comprises only sixteen percent of methane hydrates and the remainder of the hydrate is composed of frozen freshwater[1426], the global pre-occupation with hydrocarbons has caused methane hydrates to be viewed as an alternative source of hydrocarbon energy.[1427] Therefore, treaties between states that address development of transboundary offshore natural resources and minerals as well as those that address hydrocarbon development would govern development of transboundary seabed methane hydrates. Currently, the freshwater in methane hydrates is treated as a disposable by-product[1428], and techniques for its recovery have not yet been designed. Thus, development of the freshwater in seabed methane hydrates will require newer techniques that will separate and preserve both the water and the methane. At the moment, capture of the methane itself is difficult, since the hydrate dissociates when

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[1426] *Frozen Heat: A Global Outlook on Methane Gas Hydrates (Executive Summary)* (United Nations Environment Programme 2014) 8

[1427] Julia Hollingsworth, 'China is tapping into a new source of energy from 'flammable ice'' (*Business Insider UK*, 13 June 2017) < http://uk.businessinsider.com/china-extracts-fuel-frozen-deposits-seabed-methane-gas-methane-hydrate-2017-6?r=US&IR=T> accessed 28 February 2018; Sarah Lazarus, 'Can Japan burn flammable ice for energy?' (*CNN*, 1 November 2017) <http://edition.cnn.com/2017/10/31/asia/on-japan-flammable-ice/index.html> accessed 1 November 2017

[1428] Lazarus (n 1427)

taken out of its medium-to-high pressure, low temperature environment.[1429] Until the price of freshwater makes it an economically valuable commodity, the freshwater in methane hydrates will doubtless continue to be discarded, and research will be devoted to capture of the hydrocarbon. This singular classification of methane hydrates creates a gap in law and practice that favors the less voluminous component of the hydrate over the much larger freshwater component. In a water-scarce future, freshwater may well be much more valuable than hydrocarbons, and the current classification may be renegotiated, especially if the freshwater can be captured but is still viewed legally as an inconsequential by-product.

In the absence of an applicable treaty, nations sharing transboundary seabed aquifers or methane hydrates may wish to consult the law of land-based freshwater resources for guidance in crafting agreed principles of cooperation. The scope of the two global treaties for land-based freshwater resources[1430] does not extend beyond the coastline, so nations looking to the law of land-based freshwater resources for guidance will have to rely on principles of international customary law. Chapter 3 related that the international customary law of land-based surface freshwater consists of a few key, and occasionally conflicting, principles: reasonable and equitable utilization of the resource; no significant harm to a neighbor's rights or interests; cooperation; data sharing; environmental protection, and advance notice of planned activities that would significantly affect a neighbor. The customary law of land-based aquifers is still in an embryonic stage, but the emerging principles could include data sharing,

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[1429] Laura A Stern and others, 'Anomalous Preservation of Pure Methane Hydrate at 1 atm' (2001) 105 Journal of Physical Chemistry B 1756, 1756

[1430] Convention on the Protection and Use of Transboundary Watercourses and International Lakes (adopted 17 March 1992, entered into force 6 October 1996) UNTS 1936; ILM 1312 (UNECE Water Convention) art 1.1 ('wherever transboundary waters flow directly into the sea, these transboundary waters end at a straight line across their respective mouths between points on the low-water line of their banks'). The UN Watercourses Convention does not directly address offshore water resources, but one can infer that these resources are excluded from its scope by the fact that the definition of 'watercourses' includes only those waters 'flowing into a common terminus', which would include the ocean. Convention on the Law of the Non-navigational Uses of International Watercourses (adopted 21 May 1997, entered into force 17 August 2014) 36 ILM 700 (UN Watercourses Convention) art 2(a) See also Chapter 1.3.

advance notice and joint management commissions, since those three practices are common to all four of the fully-ratified treaties as well as the draft treaties that are focused solely on transboundary land-based aquifers. Interestingly, all of the practices that are common to transboundary aquifer treaties are fully consistent with principles in the agreements that nations have reached for offshore hydrocarbon development. Procedural principles for land-based freshwater such as notice, cooperation and environmental protection are already applicable to marine natural resources, but application of the two substantive principles beyond the shoreline is questionable. There is no requirement to utilize non-living seabed resources in an equitable and reasonable manner, and the prohibition against significant harm in a marine context is limited to a due diligence obligation. In light of the growing acceptance of a human right to water discussed in Chapter 5.2.1, one could argue that a requirement for equitable utilization now includes adequate allocation to support human rights to water. It remains to be seen whether the synergistic connections between these two land-based principles will evolve into an obligation for offshore freshwater to be utilized to meet human rights obligations.

For all of the reasons discussed above, one can comfortably predict that, should development of transboundary offshore freshwater resources begin in the near future, nations will utilize legal structures that have evolved for development of other offshore natural resources, especially hydrocarbons. Seabed aquifers and methane hydrates emplaced within the territorial sea or the EEZ Seabed of a single nation will be deemed to be the exclusive dominion of that nation. Transboundary seabed aquifers and methane hydrates lying within the territorial sea, the EEZ Seabed or the OCS will be developed following well-honed and widely-accepted unitization and joint development structures. Benefits from resources found outside of the EEZ Seabed but within the OCS will be shared under a system yet to be designed by the ISA under the purview of LOSC. This analysis would also apply to any offshore aquifers that have a hydraulic link to land-based coastal aquifers, since the legal regime changes at

the shoreline. However, any impact of offshore freshwater extraction on land-based aquifer levels may compel states to adopt integrated coastal zone management of hydraulically connected freshwater resources. Since they have no coastlines and therefore no rights under LOSC to offshore natural resources, landlocked states have no direct rights to offshore freshwater.

All of the environmental protection obligations noted in Chapter 5.1.2 will apply to transboundary resource development. Additional obligations for transboundary activities arise in the form of requirements under LOSC and customary law to perform environmental impact assessments and to prevent significant harm to a neighboring state's territory. As described in Chapter 4.4, seabed development activities carry the risk of causing significant damage, including seabed subsidence, collapse of the continental rise, tsunamis and methane release. While states may seek monetary compensation for economic and environmental damage, sometimes only an injunction prohibiting the potentially harmful activity will prevent catastrophic damage. At this point in time, such injunctions against state activity are not available, even when the evidence is clear. For example, Ireland brought legal actions in several fora in order to gain information about the environmental impacts of a United Kingdom MOX (mixed oxide fuel) facility in an effort to halt operations that Ireland claimed would have had significant detrimental effects on the Irish Sea. Ireland had great difficulty finding a court that would accept jurisdiction[1431], and the MOX plant ultimately was shut down not because of legal action but because of a shift in government policy after the Fukushima nuclear disaster[1432]. The lack of a clear path to injunctions that would significant damage is a clear gap in the legal regime that purports to provide for environmental protection. However, the prospect of states agreeing to such a broad limitation on their sovereignty is not bright.

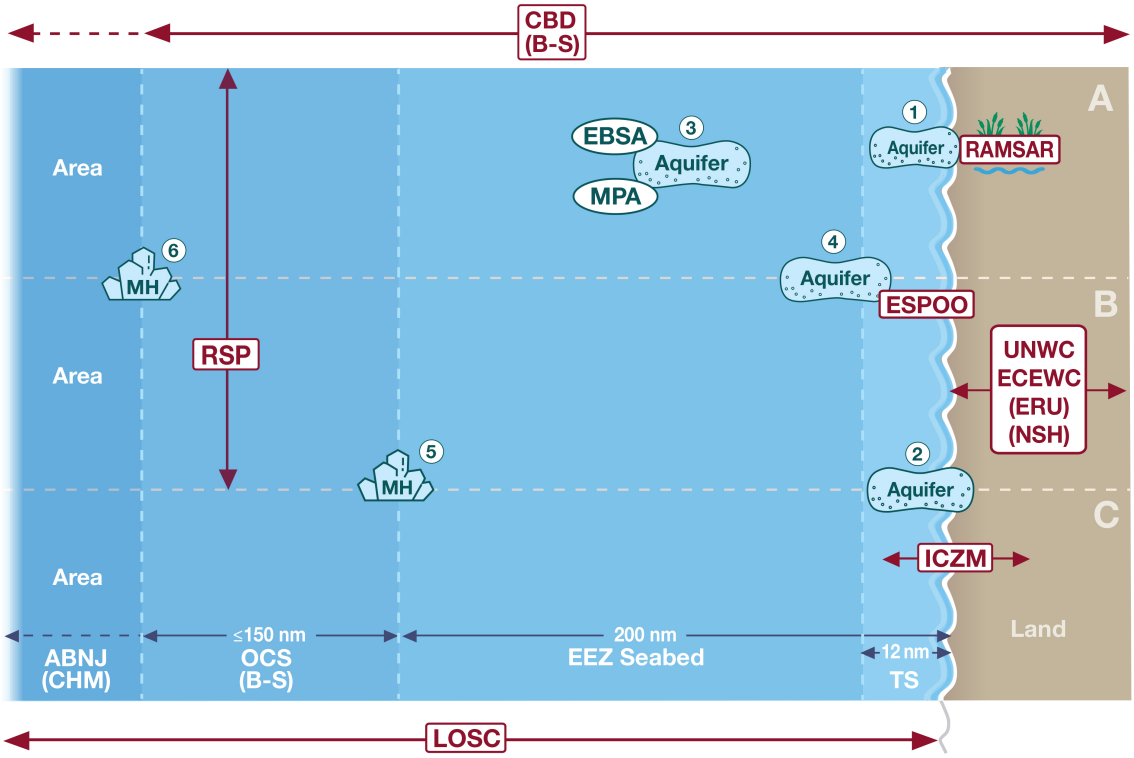
[1431] Maki Tanaka, 'Lessons from the Protracted MOX Plant Dispute: A Proposed Protocol on Marine Environmental Impact Assessment to the United Nations Convention on the Law of the Sea' (2004) 25 Michigan Journal of International Law 337

[1432] Fiona Harvey, 'Sellafield Mox nuclear fuel plant to close' (*The Guardian*, 3 August 2011) <https://www.theguardian.com/environment/2011/aug/03/sellafield-mox-plant-close> accessed 3 December 2011

5.1.4 Some scenarios

This section will attempt to synthesize and summarize the conclusions regarding application of legal regimes to offshore freshwater resources that were discussed above and in the previous chapters through consideration of the six hypothetical scenarios depicted in Figure 1 below. Four of the scenarios address offshore aquifers, and two address methane hydrates. Since technology for recovery of the freshwater component of methane hydrates has not yet been developed, for the foreseeable future the resource will be valued solely for its hydrocarbons. Nevertheless, methane hydrates will be included among the scenarios in case recovery of the freshwater becomes technically possible and financially attractive under current legal regimes. For purposes of the scenarios, methane hydrates will be treated as a single resource. The analyses of the scenarios will mainly address rights and obligations that accompany ownership and the effects that those rights and obligations have on development of seabed resources such as freshwater. However, in addition to rights of access and ownership, states must determine how to resolve the underlying tension between market forces and the rights of humans and other species to an adequate supply of freshwater for life and well-being.

Figure 1



Key:

- A, B and C: Sovereign states
- ABNJ: Area beyond national jurisdiction
- B-S: Benefit-sharing
- CBD: Convention on Biological Diversity
- CHM: Common heritage of mankind
- EBSA: Ecologically or biologically significant area
- ECEWC: UNECE Water Convention
- EEZ: Exclusive economic zone
- ERU: Equitable and reasonable utilization
- Espoo: Convention on Environmental Impact Assessment
- ICZM: Integrated Coastal Zone Management
- LOSC: UN Convention on the Law of the Sea
- MH: Methane hydrate
- MPA: Marine protected area
- nm: Nautical mile
- NSH: No significant harm

- OCS: Outer continental shelf
- Ramsar: Convention on Wetlands
- RSP: Regional Seas Programme
- TS: Territorial sea
- UNWC: UN Watercourses Convention

The following scenarios will be analyzed below:

- Scenario 1: Domestic offshore aquifer hydraulically connected to wetlands protected by Ramsar Convention, being a party to LOSC, the CBD and the regional seas programme (RSP)
- Scenario 2: Transboundary offshore aquifer hydraulically connected to transboundary terrestrial aquifer, with one of the states being a party to a RSP treaty
- Scenario 3: Domestic offshore aquifer in the EEZ Seabed bordering an EBSA and a MPA, with the state being a party to a RSP treaty
- Scenario 4: Transboundary offshore aquifer straddling the territorial sea and EEZ Seabeds, with the states being parties to a RSP treaty
- Scenario 5: Transboundary methane hydrate deposit straddling the EEZ Seabed and the outer continental shelf (OCS), with one of the states being a party to a RSP treaty
- Scenario 6: Transboundary methane hydrate deposit straddling the OCS and the area beyond national jurisdiction (ABNJ), with the states being parties to a RSP treaty

Scenario 1: Domestic offshore aquifer hydraulically connected to wetlands protected by Ramsar Convention, with the state being a party to LOSC, the CBD and the regional seas programme (RSP)

Since the aquifer is located in the territorial sea of one state, that state has full sovereign rights to develop the resource, limited by its obligations under LOSC, the CBD, the RSP and its own domestic law to engage in required measures to

protect the environment during development activities. All the treaties and customary law obligate the state to perform an EIA and to use due diligence to protect the environment during development activities, but implementation of other protective measures is left largely to the discretion of the state acting through its domestic legislation. If the aquifer is located in the waters of a state belonging to the EU, particularly states that border the Mediterranean, North and Baltic Seas, enhanced environmental protection measures will apply. The hydraulic connection to wetlands activates obligations under the Ramsar Convention to use the wetlands wisely[1433], and thus the state may have to determine whether extraction of water from the aquifer that may reduce the freshwater in the wetland would be a wise use of the wetland. Any detrimental impact of aquifer development on the wetland would initiate a reporting requirement to the Ramsar Secretariat.[1434] In this scenario and all other scenarios, if the state has implemented the human right to water, then distribution of the freshwater may extend to water-scarce inland areas.

Scenario 2: Transboundary offshore aquifer hydraulically connected to transboundary terrestrial aquifer, with one of the states being a party to a RSP treaty

Once the transboundary nature of the seabed aquifer and its connection to a land-based aquifer have been confirmed, certain rights and duties arise. If significant damage may result from development activity, then the state wishing to access the freshwater must conduct an EIA, must give notice to the other state, must cooperate and has a due diligence obligation to avoid significant transboundary harm. The fact that only one state is a party to a RSP treaty does not affect these procedural obligations, which are customary law. The more difficult issue is whether the hydraulic connection between the two aquifers initiates application of customary law for land-based aquifers. The limited

[1433] Convention on Wetlands (adopted 2 February 1971, entered into force 16 May 1976) 996 UNTS 245 (Ramsar Convention) art 3.1
[1434] ibid art 3.2; *An Introduction to the Ramsar Convention on Wetlands* (7th ed, Ramsar Convention Secretariat 2016) 15-6

number of procedural requirements in that nascent state of that body of law should all apply: cooperation, data-sharing and a joint committee. Those procedural requirements are also found in unitization structures for transboundary offshore hydrocarbons, which supports a prediction that the parties will enter into some form of joint development arrangement. The land-based customary law principle of no significant harm also applies also to transboundary seabed activities, but one wonders whether maritime or terrestrial laws would apply to a claim of significant environmental damage. The principle of equitable and reasonable utilization (ERU) of land-based surface water has not yet been fully accepted as a principle for land-based transboundary aquifers or transboundary seabed resources, so its application for transboundary seabed aquifers is doubtful. However, the human right to water may find synergies and support in ERU in urging utilization of freshwater from hydraulically-linked land and seabed aquifers to serve human and other needs.

Scenario 3: Domestic offshore aquifer in the EEZ Seabed bordering an EBSA and a MPA, with the state being a party to a RSP treaty

As in the first scenario, since the aquifer is situated in the domestic waters of a single state, that state will have sovereign rights to the resource, and its domestic laws and regulations will govern exploration and extraction, with obligations under LOSC, the CBD, the RSP and its own domestic laws to conduct an EIA and to use due diligence to prevent significant harm. States in a European RSP will have enhanced environmental monitoring and reporting obligations. The CBD designation of EBSA carries no legal weight, but may have influenced the state's designation of a MPA through contribution of scientific evidence regarding the environmental significance of the area. The MPA will carry restrictions on development activities that may range from a complete ban on development in the area to allowing development that does no significant damage to the surrounding environment.

Scenario 4: Transboundary offshore aquifer straddling the territorial sea and EEZ Seabeds, with the states being parties to a RSP treaty

The demarcation between the territorial sea and the EEZ Seabed makes no practical legal difference for seabed development purposes since the states have exclusive rights to seabed natural resources in both areas. Depending on which RSP treaty is applicable, the parties could have significant environmental protection obligations that could limit or even prohibit development activities, especially in Mediterranean, North and Baltic Seas. At a minimum, the parties must notify each other of potential significant harm, communicate about their activities and cooperate. If the states are members of the UNECE, then they probably belong to the Espoo Convention, which carries heightened requirements regarding production of an early EIA and notification and consultation regarding any major project that has the potential to cause significant environmental harm. Due to the distance from shore, offshore drilling equipment would be necessary in this scenario, and regulations regarding use and disposal of cuttings and produced water will almost certainly be in place. To achieve efficiency and secure an equitable arrangement, the states will probably unitize the resource and appoint a single operator.

Scenario 5: Transboundary methane hydrate deposit straddling the EEZ Seabed and the outer continental shelf (OCS), with one of the states being a party to a RSP treaty

The states must abide by the procedural and substantive obligations to protect the seabed environment noted above that are contained in LOSC and the CBD. The state that is a party to an RSP will likely have enacted domestic legislation in conformity with its RSP obligations, while the other state may have more lax environmental protection requirements. Unless they are already parties to a treaty addressing offshore hydrocarbons, the states will likely enter into discussions leading to a joint development agreement. That agreement will determine their proportionate shares of revenues and expenses, will establish a

joint committee with greater or lesser autonomy, and will arrange for appointment of a single operator. In addition, under an agreement that will be negotiated with the ISA, up to seven percent of the benefits derived from exploitation must be given to the ISA for distribution to disadvantaged states. There is no precedent or guidance regarding transboundary natural resources in the OCS, but one can assume that the ISA would negotiate a separate formal agreement with each state.

Scenario 6: Transboundary methane hydrate straddling the OCS and the area beyond national jurisdiction (ABNJ), with the states being parties to a RSP treaty

In the OCS seabed, unless there is already a treaty in place, the states will probably enter into negotiations for a joint development agreement, even if their maritime boundaries have not yet been delimited. The development agreement will determine their respective shares of revenues and expenses, establish a joint committee and appoint a single operator. In addition to establishing their own agreement for joint development, states will also have to negotiate an understanding with the ISA regarding two significant issues – the mechanism for determining the amounts that must be contributed to ISA for development in the OCS, and the right to develop ABNJ minerals that are viewed as the common heritage of mankind. The Mining Code, with its regulations addressing prospecting, exploration and (ultimately) exploitation, will apply to development activities in the ABNJ. The environmental protection obligations included in LOSC, CBD, applicable RSP treaties and domestic legal regimes will apply to areas within national jurisdiction. The scope of the CBD extends to 'activities and processes' in ABNJ, and the meaning of that provision is now being negotiated as part of the draft implementing agreement to LOSC that addresses protection of biodiversity in ABNJ. Although there is no clear

obligation to perform an EIA in ABNJ[1435], the ISA Mining Code requires establishment of an environmental baseline during the prospecting and exploration phases of mineral development in the ABNJ[1436].

5.2 Emerging trends

The preceding section summarized the conclusions regarding governance of offshore freshwater that can be drawn from Chapters 2, 3 and 4 based on current laws, and it predicted the legal regimes that would apply in various scenarios presented by Figure 1. However, the law is not static, and in the first decades of the twenty-first century new trends advocating more equitable distribution of water and other natural resources are gaining traction and may become more mainstream by the time that offshore freshwater resources are actively developed. The practical possibility of achieving a fair balance of equitable distribution may be doubtful under existing political, financial and sovereign structures, but the difficulty of arriving at an equitable solution should not prevent re-assessment of existing modes of governance and the generation and discussion of ideal scenarios. Under the global political structure that has been evolving since the Westphalian nation-states, equitable distribution of natural resources can only be enacted by sovereign states, the limitations on sovereignty that have been increasing in number and breadth do not address allocation of freshwater. The ability of large, entrenched human systems to react quickly and effectively to humanitarian needs is questionable at best, in spite of noble declarations and honorable intentions. In 2016, three hundred thirty million people were affected by drought in India alone[1437], and in March 2017, an estimated twenty million people were at risk of starvation due

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[1435] Andrew Friedman, 'Submarine Telecommunication Cables and a Biodiversity Agreement in ABNJ: Finding New Routes for Cooperation' (2017) The International Journal of Marine and Coastal Law 1, 5

[1436] ISA Legal and Technical Commission, 'Recommendations for the guidance of contractors for the assessment of the possible environmental impacts arising from exploration for marine minerals in the Area' (1 March 2013) UN Doc ISBA/19/LTC/8, para 1

[1437] 'India drought: '330 million people affected'' (*BBC*, 20 April 2016) <http://www.bbc.com/news/world-asia-india-36089377> accessed 5 February 2018

to droughts and conflicts, despite the efforts by relief agencies[1438]. When widespread absolute water scarcity becomes a tragic reality, contemporary models of sovereign control over natural resources may not be adequate to meet human needs, much less sustain other species and ecosystems. The pressures that accompany increasing populations will be exacerbated by climate change, and international law will be pressed to provide guidance in order to avoid conflict over vital natural resources such as freshwater.[1439]

As Eyal Benvenisti has observed, humanity no longer lives in luxuriously large sovereign estates, but rather each nation can be viewed as 'owning a small apartment in one densely packed high-rise that is home to two hundred separate families'.[1440] Twentieth century initiatives toward global collaboration such as the UN could provide the genesis for even greater, borderless cooperation in the twenty-first century when vast populations may suffer from the effects of climate change and drought. The system of balkanized, parochial nation-states may gradually cede to more communal efforts. Naturally, nation-states will first have to provide for their own needs, but freshwater in excess of those needs could be made available for the most water-scarce populations.

Scientific modeling predicts that the volume of fresh to slightly brackish water lying in coastal seabeds could be two orders of magnitude greater than the volumes withdrawn from land-based aquifers since 1900.[1441] Estimates of the volume of seabed methane hydrates vary widely, but even the lower estimates

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[1438] David Pilling, 'Why is the world facing the worst humanitarian crisis since 1945?' (*Financial Times*, 15 March 2017) < https://www.ft.com/content/bbf48ad8-08af-11e7-ac5a-903b21361b43> accessed 5 February 2018

[1439] Joseph W Dellapenna, 'International Water Law in a Climate Of Disruption' (2008) 17 Michigan State Journal of International Law 43, 52

[1440] Eyal Benvenisti, 'Sovereigns as Trustees of Humanity: On the Accountability of States to Foreign Stakeholders' (2013) 107 American Journal of International Law 295, 295. David Kennedy uses the metaphor of a global village, 'in which law is now enmeshed with policy, politics and practical reason'. David Kennedy, 'International Law and the Nineteenth Century: History of an Illusion' (1997) 17 Quinnipiac Law Review 99, 136

[1441] Vincent A Post and others, 'Offshore Freshwater Groundwater Reserves as a Global Phenomenon' (2013) 504 Nature 71, 75

predict significant resources, with freshwater comprising eighty-five percent of the resource.[1442] While exploration and exploitation of these resources may be costly, the economic, humanitarian and environmental benefits derived from wider distribution could be enormous. If the projected volumes of offshore freshwater are even close to being correct, agreeing to more equitable distribution may not present a significant hardship to coastal states.

In the coming decades, our species will be challenged to manage the planet's finite natural resources that we share with other species and that we must safeguard for future generations. How we respond to that challenge will determine the fate of all creatures. The next subchapters will discuss several emerging legal and philosophical trends that present potential solutions.

5.2.1 Right to water

As the demands for sufficient quality and quantities of freshwater began to surpass supplies in many parts of the world, recognition of a human right to water rose into the consciousness of global bodies. The first UN statement regarding a human right to water was adopted in a resolution that accompanied the influential 1977 Mar del Plata Action Plan:

> All peoples, whatever their stage of development and social and economic conditions, have the right to have access to drinking water in quantities and of a quality equal to their basic needs.[1443]

A subsequent mention of water as a human right was included in the 1992 Dublin Statement on Water and Sustainable Development (Dublin Statement). Although the fourth Guiding Principle of the Dublin Statement declares that

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[1442] EB Burwicz, LH Rüpke and K Wallmann, 'Estimation of the global amount of submarine gas hydrates formed via microbial methane formation based on numerical reaction-transport modeling and a novel parameterization of Holocene sedimentation' (2011) 75 Geochimica et Cosmochimica Acta, 4562, 4574

[1443] Resolution II, 'Report of the United Nations Water Conference' (Mar del Plata 14-25 March 1977) UN Doc E/Conf.70/29

'water should be recognized as an economic good', the explanation to that principle states that 'it is vital to recognize first the basic right of all human beings to have access to clean water and sanitation at an affordable price'.[1444] More than thirty years after issuance of the Mar del Plata Action Plan, the UNGA adopted resolutions in 2010, 2013 and 2015 that declared, affirmed and reaffirmed 'the right to safe and clean drinking water and sanitation as a human right that is essential for the full enjoyment of life and all human rights'.[1445] In addition, in 2010 the UN Human Rights Council affirmed that

> the human right to safe drinking water and sanitation . . . is derived from the right to an adequate standard of living . . . and the right to . . . physical and mental health, as well as the right to life and human dignity.[1446]

The human right to water is not explicitly mentioned in the Universal Declaration of Human Rights or in the International Covenant on Economic, Social and Cultural Rights (ICESCR),[1447] but in a report submitted to the UN General Assembly the UN Special Rapporteur on the human right to safe drinking water and sanitation Léo Heller sees human rights to water as being included in the obligations accepted by states in the ICESCR[1448]. Further, he noted that Committee on Economic, Social and Cultural Rights sees a state obligation to respect human rights to water in other states, which includes avoidance of actions by itself and its citizens that would interfere with enjoyment of those rights.[1449]

[1444] 'The Dublin Statement and Report of the Conference', International Conference on Water and the Environment, Dublin, Ireland (World Meteorological Organization 1992)
[1445] UNGA Res 64/292 (28 July 2010); UNGA Res 68/157 (18 December 2013); UNGA Res 70/169 (17 December 2015). The 2015 resolution characterized 'human rights to safe drinking water and sanitation as components of the right to an adequate standard of living.'
[1446] Human Rights Council, 'Human rights and access to safe drinking water and sanitation' (6 October 2010) UN Doc A/HRC/Res/15/9, para 3
[1447] Inga Winkler, *The Human Right to Water* (Hart Publishing 2012) 9, 37
[1448] UNGA, 'Human rights to safe drinking water and sanitation' (5 August 2016) UN Doc A/71/302, para 9
[1449] ibid para 11

In spite of this expansive view of the right to water, in the opinion of Inga Winkler the human right to water has not yet achieved the status of customary law or a general principle of international law regardless of the international attention it has received in recent years[1450]. Nevertheless, she argues that, as with other economic, social and cultural rights, states still have a legally binding obligation 'to respect, to protect and to fulfill the human right to water.'[1451] She sees a further state obligation of 'progressively realizing the human right to water . . . as expeditiously and effectively as possible . . . using the maximum of their available resources'.[1452] While states arguably may have an obligation to ensure access to an adequate supply of water, that supply is limited to amounts necessary for drinking water and sanitation for individuals, and not for other uses of water that serve humans such as irrigation of crops.[1453]

The human right to water can be considered as one of the plethora of human rights that have been announced in documents such as the 1776 US Declaration of Independence, the 1789 French Declaration of Rights of Man and Citizen, and the UN 1947 Universal Declaration of Human Rights. In a 2004 article Kenneth Cmeil analyzed the various incarnations of human rights movements through the last few centuries, with particular emphasis on the post-WWII period.[1454] He notes that, while activism and social media have made human rights abuses more visible, recent scholarship on the topic has underscored the 'wrenching chasm between the glowing words or strenuous activism and the very slim real results'.[1455] In the presence of almost daily atrocities, where human tragedies occur with enough frequency to numb sensitivities and inaction by global bodies is callously accepted, it would be difficult to disagree with his conclusions.

[1450] Winkler (n 1447) 96-98
[1451] ibid 107
[1452] Inga T Winkler, 'The Human Right to Water' in Alistair Rieu-Clarke, Andrew Allan, Sarah Hendry (eds), *Routledge Handbook of Water Law and Policy* (Routledge 2017) 112
[1453] ibid 130
[1454] Kenneth Cmeil, 'The Recent History of Human Rights' (2004) 109 American Historical Review 117
[1455] ibid 133

However, as Cmeil recognizes, a similar period of indifference occurred during the Cold War, and this current era of indifference may pass as well.[1456]

In her 2013 book, Edith Brown Weiss devoted an entire chapter to the human right to water.[1457] She noted that 'the international community has made significant progress in recognizing the right to water'[1458], but agrees with Winkler and Cmeil that 'the basic human rights agreements do not explicitly provide for the right [to water]'[1459]. In addition, the human right to water does not have a legal or policy home; it has been associated with an adequate standard of living, the right to food, the right to health, the right to development, the right to life and the right to dignity.[1460] The author recommends that the human right to water be tied to 'international human rights law, which is binding on governments'.[1461]

In the same year that Edith Brown Weiss published her book, the UN Human Rights Council published two reports addressing state obligations to protect the environment that were produced by John H. Knox, Independent Expert on the issue of human rights obligations relating to the enjoyment of a safe, clean, healthy and sustainable environment.[1462] These reports clarified that, while few of the multilateral environmental agreements refers explicitly to human rights, protection of natural resources such as freshwater is nevertheless closely related to protection of human rights[1463], and states have both procedural and

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[1456] ibid 135
[1457] Edith Brown Weiss, *International Law for a Water-Scarce World* (Martinus Nijhoff 2013) 191-242
[1458] ibid 193
[1459] ibid 194
[1460] ibid 214-5
[1461] ibid 225
[1462] Office of the United Nations High Commissioner for Human Rights, 'Mapping Human Rights Obligations Relating to the Enjoyment of a Safe, Clean, Healthy and Sustainable Environment: Individual Report on Global and Regional Environmental Agreements' (Report No 9, December 2013) (Knox Report No. 9); Office of the United Nations High Commissioner for Human Rights, 'Mapping Human Rights Obligations Relating to the Enjoyment of a Safe, Clean, Healthy and Sustainable Environment: Individual Report on Non-Binding International Environmental Instruments (Report No 10, December 2013) (Knox Report No. 10)
[1463] Knox Report No 9 (n 1462) para 6

substantive obligations to safeguard the environment for their citizens[1464]. In subsequent reports, Knox, who by then had become a Special Rapporteur to the UNGA, advised that state obligations to prevent environmental harm, including unsafe water, are related to their human rights obligations and extend to children[1465]. Knox's exhaustive surveys of binding and non-binding commitments taken by states could be interpreted as illustrating broad, crosscutting state acceptance of limitations on sovereignty where environmental protection is concerned. The studies could even be said to be evidence of the genesis of customary law. On the other hand, diplomatic acceptance of these obligations must be contrasted with the reality of continued degradation of the environment, including freshwater. Nevertheless, while policymakers debate the full force of the human right to water and millions continue to lack access to safe water, it seems fair to say that the human right to water remains a philosophical concept rather than an enforceable right.

The human right to water does not include the right of other species and ecosystems to their own share of water, in spite of the fact that humans cannot survive alone on the planet. In the past decade the rights of ecosystems have been recognized in several national laws. Ecuador granted rights to nature in its 2008 Constitution[1466], in 2010 Bolivia adopted the Law of the Rights of Mother Earth[1467], and more recently New Zealand has granted legal personhood to the Te Urewera National Park[1468] and the Whanganui River.[1469] In 2017 the Indian Uttarakhand high court ruled that the Ganga and Yamuna Rivers are living

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[1464] Knox Report No 10 (n 1462) para 5

[1465] UNGA, 'Report of the Special Rapporteur on the implications for human rights of the environmentally sound management and disposal of hazardous substances and wastes' (2 August 2016) UN Doc A/HRC/33/41, para 27; UNGA, 'Report of the Special Rapporteur on the issue of human rights obligations relating to the enjoyment of a safe, clean, healthy and sustainable environment' (24 January 2018) UN Doc A/HRC/37/58 (Knox 2018) para 1 The 2018 report also cites support for environmental protection in the Convention on the Rights of the Child (adopted 20 November 1989, entered into force 2 September 1990) 1577 UNTS 3; 28 ILM 1456

[1466] Constitution of the Republic of Ecuador (20 October 2008) ch 7, arts 71-74

[1467] Law of Mother Earth (Law 071 of the Bolivian Plurinational State)

[1468] Te Urewera Act 2014 (New Zealand Public Act 2014 No 51)

[1469] Tutohu Whakatupua Agreement between the Whanganui Iwi and the Crown, Office of Treaty Settlements New Zealand (30 August 2012)

entities, but that ruling was stayed by the Indian Supreme Court.[1470] Also in 2017, the Colombian Constitutional Court ruled that the River Atrato had rights to protection, conservation, maintenance and restoration.[1471] Whether these few examples will gather enough momentum to become a recognized trend remains to be seen, but their very existence suggests that awareness of the value of ecosystems is rising. In addition, the CBD serves to protect and preserve biodiversity. Since all land-based life forms require access to freshwater, the CBD therefore can be interpreted as supporting the rights of nature through allocation of freshwater to thirsty ecosystems.

In the opinion of Nandita Singh, '[n]o good policy, law, or program can help people realize their right [to water] unless safe water as a resource is available in adequate quantity'.[1472] One can logically conclude that in a future where freshwater is in short supply due to stresses such as overpopulation and climate change, severe water scarcity will affect an increased number of people as well as ecosystems and other species. In such a dystopian future, one can also predict that conflicts over freshwater will appear. Under those circumstances, an equitable method of governing and distributing a new seabed source of freshwater would be more critical than ever in order to provide adequate hydration for humans and ecosystems and to forestall conflicts. An equitable method of freshwater allocation would serve pragmatic needs by ensuring the survival of humans and other species while at the same time producing a new normative approach to distribution of natural wealth.

States have clear obligations to protect the environment and its biodiversity through LOSC, the CBD, regional agreements and customary law. At the same

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[1470] 'SC stays Uttarakhand HC order on Ganga, Yamuna living entity status' (*The Indian Express*, 8 July 2017) <http://indianexpress.com/article/india/sc-stays-uttarakhand-hc-order-on-ganga-yamuna-living-entity-status-4740884/> accessed 7 February 2017

[1471] Bram Ebus, 'Colombia's constitutional court grants rights to the Atrato River and orders the government to clean up its waters (Mongabay, 22 May 2017) <https://news.mongabay.com/2017/05/colombias-constitutional-court-grants-rights-to-the-atrato-river-and-orders-the-government-to-clean-up-its-waters/> accessed 18 February 2018

[1472] Nandita Singh, 'Translating the Human Right to Water into Reality: Concluding Remarks' in Nandita Singh (ed), *The Human Right to Water: From Concept to Reality* (Springer 2016) 224

time, there are soft law obligations to ensure a human right to water, the rights of children to a livable planet and the rights of nature to survive. Taken together, these obligations can be viewed as some of the growing number of limitations on sovereignty that would apply to offshore freshwater. Offshore aquifers, whose waters are easier to access than methane hydrates, represent a significant reserve of a uniquely vital resource. Through acceptance of limitations on unfettered sovereign rights to utilize an additional cache of freshwater, nations could recognize and accept resource allocations outside the normal commercial systems that capture resources requiring financial investment. Similar to their LOSC obligation to share the benefits of resources in the OCS, states could accept having hard and soft law obligations to reserve some of the offshore freshwater for beneficial uses in order to honor the rights of humans, of other species and of nature itself to have access to adequate volumes of freshwater to sustain life. The amount of that allocation may depend on a number of factors, including the current and projected needs of a state's own populace and ecosystems. Treaties for transboundary resources could also be viewed as having a requirement to include beneficial allocations for humanity, biodiversity and ecosystems. Current law weighs more heavily toward protecting financial interests, but acceptance of sovereign obligations to ensure more equitable distribution of vital resources may tip the scale toward greater focus on protecting humans and other species both now and for the future. Offshore aquifers could represent an opportunity for states to implement their obligations to ensure rights to water by ensuring adequate allocation of a large, newly-found resource to holders of those rights.

5.2.2 Benefit-sharing

Benefit-sharing is another limitation on sovereignty that has seen growing acceptance in recent years. Currently, there are two treaties that carry obligations for benefit-sharing of natural resources.[1473] The Convention on

[1473] Non-binding instruments that recommend benefit-sharing include Declaration of Helsinki, the Council for International Organizations of Medical Science (CIOMS) International Ethical

Biological Diversity (CBD)[1474] features benefit-sharing of genetic resources as one of its three main objectives[1475]. LOSC requires benefit-sharing in areas both within and beyond national jurisdiction: Article 82 mandates that a state make 'payments or contributions in kind' of up to seven percent of the 'value or volume of production' of the non-living resources of the seabed in its OCS, and in the ABNJ benefit-sharing is accomplished through CHM.

Although benefit-sharing has not yet taken on the mantle of a general legal obligation outside of biodiversity law[1476], Dire Tladi has observed that, due to continued objections to the breadth of sharing under the principle of a common heritage of mankind (CHM), the more limited scope of benefit-sharing has allowed it to advance and fill the gap left by the retreat of CHM.[1477] The appeal of benefit-sharing is that it preserves some of the moral imperative of CHM while allowing states to retain their sovereign interests in natural resources[1478]. Benefit-sharing under the CBD has a greater geographic reach than CHM, since the CBD extends to all areas under national jurisdiction, whereas CHM applies only to resources beyond sovereign jurisdiction. Elisa Morgera argues that benefit-sharing is emerging as a general principle of international law in

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Guidelines for Biomedical Research Involving Human Subjects, the Human Genome Organization (HUGO) Ethics Committee's Statement on Benefit Sharing, and UNESCO's Universal Declaration on the Human Genome and Human Rights, and Universal Declaration on Bioethics and Human Rights. Pamela Andanda and others, 'Legal Frameworks for Benefit Sharing: From Biodiversity to Human Genomics' in Doris Schroeder and Julie Cook Lucas (eds), *Benefit Sharing: From Biodiversity to Human Genetics* (Springer 2013) 33; Doris Schroeder and Julie Cook Lucas, 'Benefit Sharing: From Biodiversity to Human Genetics—An Introduction' in Doris Schroeder and Julie Cook Lucas (eds), *Benefit Sharing: From Biodiversity to Human Genetics* (Springer 2013) 4

[1474] Convention on Biological Diversity (adopted 14 June 1992, entered into force 29 December 1993) 1760 UNTS 79 (CBD) art 15.1

[1475] ibid art 1 The other two objectives are 'the conservation of biological diversity' and 'the sustainable use of its components'.

[1476] Andanda and others (n 1473) 33

[1477] Dire Tladi, 'The Common Heritage of Mankind and the Proposed Treaty on Biodiversity in Areas beyond National Jurisdiction: The Choice between Pragmatism and Sustainability' (2015) 25 Yearbook of international Environmental Law 113, 114

[1478] Bege Dauda, Yvonne Denier and Kris Dierickx, 'What Do the Various Principles of Justice Mean Within the Concept of Benefit Sharing?' (2016) 13 Bioethical Inquiry 281, 282

alignment with the principle of equity[1479], and the fact that benefit-sharing is being considered for marine genetic resources in the Area[1480] is an encouraging sign that the concept is indeed gelling into a general obligation under international law.

The CBD's benefit-sharing principle is embodied in Article 15 of the treaty.[1481] After 'recognizing the sovereign rights of states over their natural resources'[1482], Article 15 provides for benefit-sharing by obligating parties that derive any research, development and commercial benefits from genetic resources to adopt 'legislative, administrative or policy measures' and to take action through the 'financial mechanism' established in the treaty in order to share the benefits 'in a fair and equitable way' with a state-party that provides the underlying genetic resources.[1483] The provision was meant to give developing countries a share in the proceeds from genetic resources that originated in their jurisdiction when those resources are then transformed into commercial products by entities from developed countries. Eighteen years after adoption of the CBD, the Nagoya Protocol[1484] put some meat on the bare bones of the CBD's Article 15 and expanded the scope of benefit-sharing to include traditional knowledge about the genetic resources as well as the genetic resources themselves.[1485] As Matthias Buck, chief negotiator of the Nagoya Protocol for the European Union, stressed, the communities providing the traditional knowledge, and not the

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[1479] Elisa Morgera, 'Fair and equitable benefit-sharing in a new treaty on marine biodiversity: A principled approach towards partnership building?' (2018) BENELEX Working Paper N. 16, 6 <https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3234346> accessed 2 December 2018

[1480] Elisa Morgera, 'Equity and benefit sharing from marine genetic resources in areas beyond national jurisdiction' (*International Institute for Environment and Development*, April 2018) 1 <http://pubs.iied.org/pdfs/17462IIED.pdf> accessed 26 August 2018 The proposed implementing agreement for protection of biodiversity in the Area is discussed in Chapter 2.2.5.

[1481] CBD (n 1474) art 15.1

[1482] ibid art 15.1

[1483] ibid art 15.7

[1484] Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization (adopted 30 October 2010, entered into force 12 October 2014) UN Doc UNEP/CBD/COP/DEC/X/1 (Nagoya Protocol)

[1485] ibid art 5

states, are the intended recipients of any benefits arising from their traditional knowledge.[1486]

Until recently, legal analysis of benefit sharing largely focused on its application in bio-prospecting of genetic resources[1487] and included only the parties directly involved in the benefit creation.[1488] Yet the notion of benefit-sharing infuses a wide range of contemporary international law components, such as international environmental law, international human rights law, the law of the sea, and the Moon Treaty.[1489] According to Louisa Parks and Elisa Morgera, shades of benefit-sharing can also be found in legal disciplines as varied as 'climate change, water, food and agriculture as well as in international processes on . . . .corporate accountability'.[1490]

In an attempt to understand benefit-sharing, three researchers recently examined thirty-three articles that discussed justice in the context of benefit-sharing in global health research and bioprospecting.[1491] Their results are germane to an inquiry regarding benefit-sharing for offshore freshwater as well. They found five distinct types of justice that figured in benefit-sharing: commutative justice, distributive justice, global justice, procedural justice and compensatory justice.[1492] Two of the types of justice would not be immediately applicable to offshore freshwater development: procedural justice refers to fairness within ratified agreements, and compensatory justice reimburses persons for damages or inconvenience. Commutative justice ensures that

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[1486] Matthias Buck and Clare Hamilton, 'The Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization to the Convention on Biological Diversity' (2011) 20 Review of European Community & International Environmental Law 47, 48. The Nagoya Protocol does not apply to genetic resources originating in the LOSC Area or in the Antarctic. ibid 57

[1487] Elisa Morgera, 'The Need for an International Legal Concept of Fair and Equitable Benefit Sharing' (2016) 27 The European Journal of International Law 353, 353 (Morgera 2016)

[1488] ibid 364

[1489] ibid 357-358

[1490] Louisa Parks and Elisa Morgera, 'The Need for an Interdisciplinary Approach to Norm Diffusion: The Case of Fair and Equitable Benefit Sharing' (2015) 24 Review of European Community & International Environmental Law 353, 353

[1491] Dauda, Denier and Dierickx (n 1478)

[1492] ibid 285

nations and parties receive fair consideration in exchange for their goods or services. Those coastal nations with claims to sovereign rights over offshore freshwater resources would certainly be rightful beneficiaries of commutative justice. Distributive justice involves a redistribution of wealth and/or resources in order to mitigate disadvantages that have accrued to a particular population,[1493] which could include water-scarce coastal states and land-locked states. Global justice has the same goal as distributive justice, but embraces a larger spectrum of beneficiaries. In spite of its intellectual appeal, this analysis may not be currently applicable to natural resources. According to John Pullen, democratic political structures that have enshrined sovereign ownership of natural resources cannot be considered to exercise distributive justice, since those who gain from the system often do so at the expense of the less fortunate members of society.[1494] Full implementation of distributive justice may await an evolutionary change in approach to natural resources, with benefit-sharing leading the way.

Thomas Franck has advocated for fairness and justice through sharing of resources and their benefits. In his book on *Fairness in International Law and Institutions,* Franck remarked that since World War I 'equity as justice' has become an analytical approach to allocation of limited natural resources due to 'the failure of the earth's system of territorial boundaries satisfactorily to resolve the attribution of certain resources, such as the riches of the continental shelf'.[1495] According to his analysis, three main approaches to equitable distribution have evolved: corrective equity, broadly conceived equity and common heritage equity.[1496] Considered the most conservative of the three approaches, corrective equity is invoked exceptionally when 'the letter of the

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[1493] Margaret Moore, 'Natural Resources, Territorial Right, and Global Distributive Justice' (2012) 40 Political Theory 84, 90; Dauda, Denier and Dierickx, (1478) 282
[1494] John Pullen, 'An Essay on Distributive Justice and the Equal Ownership of Natural Resources' (2013) 72 American Journal of Economics and Sociology 1044, 1072
[1495] Thomas Franck, *The Power and Legitimacy Among Nations* (Oxford University Press 1990) 56
[1496] ibid 57

rule would kill its spirit.'[1497] As an example of corrective equity, Franck pointed to the *North Sea Continental Shelf Cases*, where the ICJ refused to use the equidistant method of delimitation, which would have greatly disadvantaged Germany.[1498] Broadly conceived equity is based on a rule of law that has fairness as its goal, a model that Franck recognizes in the LOSC requirement to use equitable principles when determining maritime boundaries.[1499] The first two types of equity involve and benefit only the states-parties whose sovereign interests are at stake.[1500] Common heritage equity, on the other hand, 'assumes instead that certain resources are the patrimony of all humanity' and includes Pardo's principles, such as 'non-ownership of the heritage, shared management, shared benefits, use exclusively for peaceful purposes, and conservation for future generations.'[1501]

Where freshwater is concerned, different types of benefits could be shared -- economic, social, ecological, cultural, political and spiritual – with economic benefits often being regarded as primary.[1502] In the past, benefit-sharing of transboundary rivers was tied to navigation and to allocation of flow through the principle of equitable and reasonable utilization.[1503] Recently, however, benefits are being viewed more broadly as the general enhancements that can be realized from use of the river.[1504] In their seminal analysis, Claudia Sadoff and David Grey listed four types of benefit-sharing with respect to shared river basins: increasing ecological benefits to the river; increasing economic benefits from the river; reducing political costs because of the river, and increasing

[1497] ibid 58
[1498] ibid 61-62
[1499] ibid 65-66
[1500] ibid 75-76
[1501] ibid 76
[1502] Undala Alam, Ousmane Dione and Paul Jeffrey, 'The benefit-sharing principle: Implementing sovereignty bargains on water' (2009) 28 Political Geography 90, 94
[1503] Morgera 2016 (n 1487) 373
[1504] Waltina Scheumann, Ines Dombrowsky and Oliver Hensengerth, 'Dams on Shared Rivers: The Concept of Benefit Sharing' in Anik Bhaduri and others (eds), *The Global Water System in the Anthropocene: Challenges for Science and Governance* (Springer 2014) 107

cooperative benefits beyond the river.[1505] Sadoff and Grey recognized that benefit-sharing 'may well require some form of redistribution or compensation' that 'will be highly situation specific, but could involve monetary transfers, granting of rights to use water, financing of investments, or the provision of non-related goods and services'.[1506] All of the benefits and forms of sharing that were highlighted by Sadoff and Grey could be realized from offshore freshwater.

When development of offshore freshwater begins, benefit-sharing should play a significant role in the discussions regarding utilization and distribution of the resource. Since the ability to access the freshwater in offshore aquifers already exists, that freshwater will almost certainly be developed before the freshwater in methane hydrates. To date, no offshore aquifer has been identified further than eighty nautical miles from shore, and none will be found in the Area. Thus, CHM will not apply to offshore aquifers, but benefit-sharing could be a vehicle for distributing the freshwater beyond national borders. The moral reasoning that led to benefit-sharing of genetic resources in the CBD will not transfer directly to offshore freshwater, since no constituency is yet utilizing the resource. However, an ethical imperative for distributive justice of a vital resource could be compelling by the time offshore aquifers are developed. On an individual, regional or global basis, coastal nations could exercise distributive justice by sharing the benefits of life-giving freshwater that has not yet been appropriated for any use. The solution reached under Article 82 of LOSC for OCS resources sets a precedent for sharing the benefits of seabed resources in national jurisdiction. Benefit-sharing of offshore freshwater could take different forms, such as equitable distribution of the water itself to humans and ecosystems or distribution of the proceeds of its sale. Another possibility would be sharing of the benefits derived from the water[1507], perhaps in the form of crops that would be irrigated by offshore freshwater. In any event, freshwater

[1505] Claudia W Sadoff and David Grey, 'Beyond the river: the benefits of cooperation on international rivers' (2002) 4 Water Policy 389, 393-400. See also Claudia W Sadoff and David Grey, 'Cooperation on International Rivers: A Continuum for Securing and Sharing Benefits' (2005) 30 Water international 420 (Sadoff and Grey 2005)
[1506] ibid 397
[1507] Alam, Dione and Jeffrey (n 1502) 90

is so uniquely important that in a water-scarce future the principles and growing practice of benefit-sharing could serve as models for spreading the watery wealth beyond the sovereigns under whose continental shelves the resources lie.

5.2.3 Freshwater as a global commons

Global distribution of freshwater is already uneven, with some nations enjoying an abundance and others suffering chronic droughts.[1508] In spite of the essential role of freshwater in supporting terrestrial life, sovereignty continues to determine rights to freshwater, and common heritage equity has not been recognized for that or any other domestic resource. Currently, discussions of benefit-sharing of freshwater focus mainly on the parties who share a particular river basin and/or aquifer.[1509] In the event that offshore freshwater is developed, interest in and need for the resource will extend beyond the coastal sovereigns, and water-scarce nations will almost certainly raise the prospect of distributive and global justice. Although scholars such as Coalter Lathrop reject a global scheme to regulate groundwater governance[1510], several proposals are converging that support a theory of treating all freshwater as one global resource.

Elena Lopez-Gunn and Todd Jarvis advanced a novel proposal that deep aquifers be viewed as a single resource that they dubbed the 'Hidden Sea'.[1511] The water in this hidden sea would be treated as a common heritage of mankind and governed in a manner similar to the LOSC Area. The global commons approach could also extend to 'atmospheric rivers', water-laden air streams in the lower troposphere that on average contribute twenty-two percent of global runoff,

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[1508] *High and Dry: Climate Change, Water, and the Economy* (World Bank Group 2016) 2-4
[1509] For example, see Rawia Tawfik, 'The Grand Ethiopian Renaissance Dam: a benefit-sharing project in the Eastern Nile?' (2016) 41 Water International 574
[1510] Coalter G Lathrop, 'Finding The Right Fit: One Design Element In The International Groundwater Resource Regime' (2009) 19 Duke Journal of Comparative & International Law 413, 413
[1511] Elena Lopez-Gunn and W Todd Jarvis, 'Groundwater governance and the Law of the Hidden Sea' (2009) 11 Water Policy 742

and up to fifty percent in some regions; regions without these atmospheric rivers flowing above them are subject to severe droughts.[1512] Atmospheric rivers play a critical role in delivering meteoric freshwater, and under current regimes no claims of sovereign ownership attach to them. In addition, during the past few years, techniques for harvesting rain[1513] and fog[1514] have been introduced; questions about ownership of those water resources passing over sovereign territories will doubtless be raised soon. If one state captures rain or fog that would have naturally passed into another state, then would that signal a return to a new version of the rule of capture? Rain and fog harvesting may lead to arrangements similar to unitization agreements to apportion a shared resource.

Partitioning water into discrete units such as rivers, lakes, aquifers, atmospheric rivers, rain and fog that carry ownership rights could become more difficult and more futile over time as the ephemeral nature of water becomes more recognized and methods for its recovery become more effective. Combining all freshwater, including offshore freshwater, into a common resource would allow global water resources to be analyzed and governed in a manner that reflects their ubiquitous and peripatetic nature. For now, the intricacies and complexities of managing and allocating all global freshwater resources prevent any detailed discussion of the idea, and serious study of the totality of freshwater on the planet awaits both technical information and political will.[1515]

Yet, some writers such as Joseph Dellapenna view water as a global common pool resource whose essential ambulatory nature belies claims of

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[1512] Homero Paltan and others, 'Global Floods and Water Availability Driven by Atmospheric Rivers' (2017) Geophysical Research Letters 44

[1513] JJ Botha, 'Alleviating Household Food Insecurity Through In-Field Rainwater Harvesting' (2012) 61 Irrigation and Drainage 82

[1514] Venkatesan Anand Ganesh and others, 'Hierarchical Structured Electrospun Nano Fibers for Improved Fog Harvesting Applications' (2017) 302 Macromolecular Materials and Engineering 1600387

[1515] Elli Louka has correctly remarked that 'international management of all freshwater resources . . . . would seem to be out of the question for the time being.' Elli Louka, *International Environmental Law: Fairness, Effectiveness and World Order* (Cambridge University Press 2006) 101

ownership.[1516] On a smaller, less global scale, Elli Louka has described shared river basins as common pool resources[1517], and at the same time she questions the effectiveness of modern international environmental law in securing equitable distribution of resources in an era of increasingly enclosed commons[1518]. Nico Schrijver has argued that, in addition to the resources already subject to CHM, such as the Area, the moon, outer space and the Antarctic,

> certain global natural assets, such as the climate system, the air, water, seeds, winds and sunshine, could also be viewed as global commons in view of the vital ecological functions that they perform for the Earth and its population.[1519]

Schrijver further suggests that the traditional, historic legal system of categorizing and governing resources separately 'does not reflect the reality of the environment and nature as a whole', where so many essential elements – air, water, soil, and climate – are intricately interconnected and interdependent.[1520] In his view, the principles that would govern the global commons have already appeared but still lack full definition, texture and implementation. Those principles include CHM, the precautionary principle, sustainability, intergenerational equity, common but differentiated responsibilities, and what he calls 'the principle of interrelatedness and integration.'[1521] In the context of offshore freshwater, modern application of sovereignty over natural resources could incorporate accepted principles such as the precautionary principle, sustainability and common but differentiated responsibilities. Given the importance of freshwater, more recent principles such as CHM, intergenerational equity and interrelatedness and integration

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[1516] Joseph W Dellapenna, 'Global Climate Distribution and Water Law Reform' (2010) 15 Widener Law Review 409, 417-418
[1517] ibid 77
[1518] ibid 95-96
[1519] Nico Schrijver, 'Managing the global commons: common good or common sink?' (2016) 37 Third World Quarterly 1252, 1253
[1520] ibid
[1521] ibid 1262

should also be given significant consideration when designing governance regimes for offshore freshwater.

For the past number of years, integrated water resources management (IWRM) has been advanced as the most logical and efficient means of utilizing water.[1522] Through IWRM both surface water and groundwater in a basin are managed as a single unit. Managing global freshwater resources as a unit would represent the next incremental step in efficient and effective utilization of the resource. Obviously, such an approach would shatter the traditional foundations of sovereignty over natural resources, yet nations have already accepted some limitations on their sovereignty, and it is possible that the evolutionary trajectory toward greater integration of water resource management will continue and broaden. That enhanced version of integrated management of all water resources would also include offshore freshwater among other forms of freshwater. Governance of this commons is beyond the scope of this thesis, but inspiration will certainly be drawn from the work of Elinor Ostrum, whose early work on shared aquifers led to her Nobel-prize winning theories regarding communal management of a commonly-held resource.[1523]

5.2.4 Post-sovereign governance of freshwater

Various authors have recently advocated for post-sovereign governance structures to confront and resolve complex issues that have been resistant to,

[1522] Dietrich Borchardt, Janos J Bogardi and Ralf B Ibisch (eds), *Integrated Water Resources Management: Concept, Research and Implementation* (Springer 2016). This book provides a series of case studies on implementation of IWRM. IWRM derives from the first of the four principles of the Dublin Statement on Water and Sustainable Development that was issued at the 1992 International Conference on Water and the Environment. That principle states that 'effective management of water resources demands a holistic approach, linking social and economic development with protection of natural ecosystems . . . . across the whole of a catchment area or groundwater aquifer.' 'The Dublin Statement and Report of the Conference', International Conference on Water and the Environment, Dublin, Ireland (World Meteorological Organization 1992). The philosophy of integrated water management on a catchment basis also appears in Chapter 18.36 and Chapter 18.39(g) of Agenda 21 of the 1992 United Nations Conference on Environment & Development (also known as the Rio Conference and the Earth Summit). ''Agenda 21, United Nations Conference on Environment & Development ' (Rio de Janeiro, Brazil, 3 to 14 June 1992)

[1523] Elinor Ostrom, *Governing the Commons* (Cambridge University Press 1990)

and even exacerbated by, traditional solutions. Stephen McCaffrey has questioned whether sovereignty should attach to water at all, given that it is constantly circulating in the hydrological cycle.[1524] Bradley Karkkainen has called for a post-sovereign approach to transboundary ecosystem management[1525], and his analysis can easily apply to water resources as well. He calls for 'multi-party collaborative governance institutions' that would include active involvement by 'local communities, NGOs, the independent scientific community, and key economic actors' and would rely on continuous engagement and commitment to designing and implementing solutions.[1526] Patricia Wouters and Dan Tarlock suggested a reconceptualization of sovereignty, whereby sovereignty would evolve from a means of control to an acceptance of responsibility towards both citizens and the greater global community.[1527] In fact, they view sovereignty as 'counter-productive' to cooperative management of transboundary water resources.[1528] David Freestone observed that traditional national sovereignty structures do not align well with sustainability measures, especially when exploitation and contamination of resources such as water are involved.[1529] Eyal Benvenisti goes even further in declaring that 'reconceptualization of sovereignty is morally required'[1530] in light of 'intensifying interdependency in relation to shared resources'[1531]. He coined a term -- *other-regardingness* -- to describe a post-sovereign regime where nations act as agents and trustees of humanity to promote 'global welfare as well as global justice.[1532] In the opinion of Kemal Baslar, the concept of nations acting as trustees where natural resources are a

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[1524] Stephen McCaffrey, 'The Coming Fresh Water Crisis: International Legal and Institutional Responses' (1997) 21 Vermont Law Review 803, 819

[1525] Bradley C Karkkainen, 'Transboundary ecosystem governance: Beyond sovereignty?' in Carl Bruch, Libor Jansky, Mikiyasu Nakayama and Kazimierz A Salewicz (eds), *Public Participation in the Governance of International Freshwater Resources* (United Nations University Press 2005)

[1526] ibid 82

[1527] Patricia Wouters and A Dan Tarlock, 'The Third Wave of Normativity in Global Water Law' (2013) 23 Water Law 51, 52

[1528] ibid 53

[1529] David Freestone, 'International Environmental Law: Principles Relevant to Transboundary Groundwater' in Salman MA Salman (ed), *Groundwater: Legal and Policy Perspectives; Proceedings of a World Bank Seminar* (The World Bank 1999) 192

[1530] Benvenisti (n 1440) 297

[1531] ibid 298

[1532] ibid 300

public trust is 'the essential part of the common heritage of mankind.'[1533] Judge Weeramantry lent support to this theory, saying in his separate opinion in the *Gabčíkovo-Nagymaros Project Case* that international environmental law should look beyond nation-states 'and their parochial concerns to the greater interest of humanity and planetary welfare'.[1534]

Prior to John Knox's report on the rights of children to a healthy environment, Edith Brown Weiss introduced a doctrine that philosophically supports a post-sovereign approach to natural resources and casts current generations as trustees for their children and their children's children.[1535] In her view, each generation 'receives a natural and culture legacy in trust' from prior generations and has an obligation to guard that trust for future generations.[1536] Brown Weiss views international law as focused on the current generation at the expense of future generations[1537], especially with respect to resource depletion, environmental degradation and exclusion of future generations from the benefits enjoyed by prior and current generations.[1538] In the doctrine of intergenerational equity, current generations must 'conserve the diversity of the natural and cultural resources base, . . . maintain the quality of the planet,' and protect access to natural and cultural legacies for both current and future generations.[1539] Such a pervasive pattern of legacy protection would not be possible under current sovereign structures, where each nation freely exploits and disposes of its resource heritage, and thus Brown Weiss called for an ombudsman to represent future generations.[1540] More recently, Brown Weiss linked the intragenerational right to water, the intergenerational right to water, sustainable development, and the International Covenant on Economic Social

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[1533] Kemal Baslar, *The Concept of the Common Heritage of Mankind in International Law* (Martinus Nijhoff Publishers 1998) 68
[1534] *Gabčíkovo-Nagymaros Project (Hungary/Slovakia)* (Merits; Judge Weeramantry Separate Opinion) [1997] ICJ Rep 115
[1535] Edith Brown Weiss, *In Fairness to Future Generations* (Transnational Publishers 1989) (Brown Weiss 1989)
[1536] Edith Brown Weiss, 'In Fairness to Future Generations' (1990) 32 Environment 6, 7
[1537] ibid
[1538] ibid 8
[1539] ibid 9
[1540] ibid 11

and Cultural Rights[1541], for each of them supports sustaining adequate freshwater quality, quantity and access for current and future generations while economic development progresses.[1542] John Knox supports the view that intragenerational equity, intergenerational equity and obligations regarding sustainable development co-exist, but he also stated that 'It is difficult, if not impossible, to define the rights of individuals who are not yet alive'.[1543]

Hydrologist Malin Falkenmark went so far as to recommend a 'water ethics body' that would produce guidelines on allocating water resources and on preserving water for future generations.[1544] Janna Thompson linked intergenerational justice and the community of nations:

> Jeopardising the well-being of future people is morally wrong . . . .So it could be argued that our obligations to future members of our society give us good reason to enter into a relationship with citizens of other intergenerational societies, who also have obligations to their future members, to ensure that all of our obligations can be fulfilled, or that we ought to build global institutions as the basis for intergenerational obligations that bind everyone.[1545]

The sovereign structures still have strong support, even among those who advocate for justice. In his book *The Power and Legitimacy Among Nations,* Thomas Franck examined the relationship between justice and the legitimacy given to sovereign power.[1546] The consequences of the rules that govern a state are not always fair and just, but Franck argues that 'the good of all is advanced

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[1541] International Covenant on Economic Social and Cultural Rights (adopted 16 December 1966, entered into force 3 January 1976) 993 UNTS 3
[1542] Brown Weiss 1989 (n 1535) 196-209
[1543] Knox 2018 (n 1465) para 67
[1544] M Falkenmark, 'Water Scarcity – Challenges for the Future' in Edward HP Brans and others (eds), *The Scarcity of Water* (Kluwer Law International 1997) 39
[1545] Janna Thompson, 'The ethics of intergenerational relationships' (2017) 47 Canadian Journal of Philosophy 313, 313, 324
[1546] Franck (n 1495)

by rules that make for an orderly deployment of power'.[1547] In his mind, the moral community must accept that the security of survival is worth the price of imperfect justice. According to this viewpoint, giving legitimacy and fealty to a sovereign and allowing it act on behalf of its citizens gives to those citizens a benefit that outweighs perfect and ubiquitous justice. Abandonment of the secular system of sovereignty might produce the larger injustice of a world splintered by fractious conflict and unable to provide those services expected from a sovereign.[1548] Further, without the sovereign state structure, power would either be dispersed into anarchy or would be concentrated in a global sovereign too distant to be concerned with individual justice.[1549] Through this lens, fairness and equity are not primary goals for society, but rather arise when more critical needs are met, such as security. The similarity of this observation to Abraham Maslow's hierarchy of needs[1550] is striking – higher level needs cannot be met until the most basic needs have been fulfilled. In addition, while the global nature of environmental challenges has become clearer, so too has the recognition that many solutions are found and implemented at the local level by domestic sovereigns.[1551]

While elimination of the state sovereign structure may not be possible or even wise, formation of a federation of states to manage vital resources could be envisioned, and, according to Franck, already exists in the community of nations.[1552] A post-sovereign world does not have to eliminate the sovereign structure; rather it merely has to extend some of the limitations that have already begun. Should post-sovereign governance regimes ever be seriously considered, a vast, untapped reserve of precious freshwater lying offshore could very well be a catalyst, or even a test case, for more intricate and equitable

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[1547] ibid 243
[1548] ibid
[1549] ibid 22
[1550] Abraham Maslow, 'A Theory of Human Motivation' (1943) 50 Psychological Review 370. According to Maslow, higher level needs depend on satisfaction of more basic needs in the following order: physiological, safety, love, esteem, and self-actualization. ibid 394
[1551] Thom Kuehls, *Beyond Sovereign Territory* (University of Minnesota Press 1996) 32, citing Kenneth Waltz
[1552] Franck (n 1495) 23-4

management and distribution that considers the needs of current and future generations that are at least as valuable as sovereign interests in natural resources. Offshore freshwater is non-renewable, and therefore any extraction is by definition unsustainable. A post-sovereign governance structure for offshore freshwater could be similar to one that would consider freshwater as a global commons, with a representative committee overseeing both exploitation and allocation to preserve the resource and prevent rampant overabstraction.

5.3 Conclusion

Current governance structures reinforce balkanization of the ocean, with sovereignty over broad swaths of offshore natural resources being assigned to coastal nations. This legal system supports both the political and economic aspirations of coastal states that wish to participate in the global financial system through trade in commoditized natural resources. Should development of offshore freshwater reserves under the continental shelves become technically and financially feasible, coastal nations will assert sovereign rights to explore, exploit, utilize and market their assigned freshwater, with transboundary deposits following the unitization and joint development patterns honed by the hydrocarbon industry. Landlocked nations would not be eligible to participate in the freshwater bounty, even though some of them rank among the least developed in the world.[1553]

The system of assigning sovereign rights to natural resources has led to gross inequities, widening gaps in wealth and unequal access to freshwater. In response to these inequities, a number of arguments for more equitable distribution have emerged: the rights of humans and ecosystems to water,

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[1553] The UN Conference on Trade and Development lists thirty-two landlocked developing states that have been 'informally accepted' by UN member states, with seventeen of the states being classified as least developed. 'List of land-locked developing countries' (*United Nations Conference on Trade and Development*) <http://unctad.org/en/pages/aldc/Landlocked%20Developing%20Countries/List-of-land-locked-developing-countries.aspx> accessed 18 March 2018 However, forty-four states -- one-fifth of the community of nations -- qualify as land-locked. Matt Rosenberg, 'Landlocked Countries' (*ThoughtCo*, 17 March 2017) <https://www.thoughtco.com/landlocked-countries-1435421> accessed 18 March 2018

benefit-sharing, water as a global commons and post-sovereign governance of natural resources. Some or all of these emerging trends may have become more acceptable by the time that offshore freshwater begins to be developed. Although seemingly unconnected, the disparate emerging philosophies discussed here can be seen as points on a continuum leading to greater compassion and inclusion. The right of humans, diverse species and ecosystems to an adequate share of vital freshwater honors the intrinsic worth of fellow terrestrial denizens and is the anchor point on the continuum. As a logical corollary to the right to water, states may agree to share the benefits of freshwater. Recent definitions of benefit-sharing have expanded beyond economic returns and resource allocation to include the benefits of greater cooperation and decreased conflict. Expanding the breadth of benefits to be shared can lead eventually to viewing freshwater as a global commons, with the resource and its benefits being allocated more widely to overcome natural and artificial scarcities. Post-sovereign governance would represent the final stage on the continuum of protecting rights and sharing benefits, since nation states would no longer claim exclusive rights to natural resources. In theory all of these concepts would allow for more equitable distribution of natural wealth. Given the vast quantities of freshwater that are presumed to lie in the seabed, following a more inclusive path to governance would represent a giant leap forward in our cultural evolution.

However, for the foreseeable future, sovereignty and sovereign claims to freshwater will be upheld by international, regional and domestic legal regimes. The rights to water, protection of biodiversity, and benefit-sharing have garnered enough support in recent decades to declare them to be well-established in theory and in practice, although their practical effectiveness is questionable in spite of their growing philosophical acceptance. At this point proposals for a global commons and post-sovereign governance have yet to be manifested anywhere except in scholarly publications.

Although their work was focused on shared surface water, Claudia Sadoff and David Grey's thoughts on cooperation may apply equally to shared offshore freshwater reserves. They recognized that, while benefit-sharing of freshwater was characterized by the assignment of rights during the twentieth century, the principle of reasonable and equitable use may have decreasing utility for sharing water as demands on diminishing water supplies become more pronounced.[1554] Once states are secure in their rights, they can then enter into discussions to determine any benefits to cooperation. Economic benefits may take precedence over other benefits, but consideration of additional types of benefits will allow states to find creative ways to cooperate and share their common resource.[1555] Sadoff and Grey view cooperation as a series of progressive stages, going from unilateral action to coordination to collaboration, and finally to joint action.[1556] Given the high costs of developing transboundary offshore freshwater, states will probably proceed immediately to joint action, using hydrocarbon practices as a template. Once the freshwater has been extracted, one can hope that other rights and practices, such as rights to water and benefit-sharing, will have matured to include parties beyond the states claiming sovereignty over the resource.

[1554] Sadoff and Grey 2005 (n 1505) 422
[1555] ibid 423
[1556] ibid 424

CHAPTER 6

CONCLUSION

As explained in Chapter 1, over-population, over-extraction, droughts, life-style changes and climate change have caused the demand for freshwater to increase exponentially, with demands expected to increase further in the coming decades. Many surface freshwater resources are dwindling and/or contaminated, leading to a search for additional and alternate supplies such as land-based aquifers and desalinated seawater. Chapter 1 also explained that vast volumes of additional freshwater supplies have been found under continental shelves around the globe in the form of fresh to slightly brackish water in aquifers and frozen freshwater in methane hydrates. Because offshore freshwater resources have not yet been utilized, no governance regime has been crafted. In the belief that rising demand for freshwater will make exploitation of offshore resources necessary in the near future, the goal of this thesis has been to fill the governance gap through exploring the legal principles that would support a governance regime and predicting the structure that would be adopted under current legal principles..

Chapter 2 explained that the UN Convention on the Law of the Sea (LOSC) codifies sovereign interests in marine natural resources. The current sovereign regimes assign benefits only to those coastal nations with the geological good fortune to have valuable natural resources lying under the continental shelves extending from their coasts. While sovereignty over resources within one nation's assigned jurisdiction has been clarified and assured, rights to transboundary resources remain undefined, with states directed by LOSC and the International Court of Justice to find equitable solutions. In agreeing to equitable solutions, states voluntarily accept some limitations on their sovereignty in exchange for the benefits that arise from cooperation. LOSC provides for sharing the benefits of resources found in the outer continental shelf, where methane hydrates will be found, but the exact mechanism of that apportionment remains unsettled. Chapter 2 also described the legal regimes

that focus on protection of the marine environment, which range from global treaties such as LOSC and the CBD to treaties derived from the Regional Seas Programme to customary law requirements such as production of an EIA where development risks causing significant transboundary harm.

Chapter 3 described the conflict between the two key international water law principles of equitable and reasonable use and no significant harm to a neighbor's rights and interests. International customary law for transboundary surface water is well-established, but principles for transboundary aquifers are only beginning to form, and thus would have limited value as analogous precedent for offshore aquifers. As related in Chapter 4, the international water law principle of equitable and reasonable utilization greatly influenced the unitization structures adopted by the offshore hydrocarbon industry. Unitization and joint development arrangements allow sovereigns to cooperate on exploration and exploitation of seabed resources while agreeing among themselves how to apportion costs, revenues and risks.

Development of offshore freshwater will await the proper synergy of demand, technology and financial support. In Chapter 5.1, this thesis predicts that any governance structure for offshore freshwater that is designed in the near future will follow the currently accepted patterns of sovereign ownership over domestic resources and will adopt unitization for transboundary resources. That sovereign structure does not achieve distributive justice for millions who live in water-scarce nations without access to freshwater supplies, nor does it provide for ecosystems that also rely on freshwater but have no voice in global governance. As the inequities of the current system of ownership and allocation become more pronounced, morality and essential fairness demand consideration of alternate approaches to sharing natural resources. Some of those alternate approaches and emerging philosophies were noted in Chapter 5.2: rights to freshwater, benefit sharing, freshwater as a global commons and post-sovereign governance. Whether any of the emerging philosophies will transition from theory to practice in freshwater governance cannot be

predicted. However, unless rational discussion and reasoned analyses are engaged, they will remain mere philosophies, and inequities in resource distribution will continue.

This thesis has given offshore aquifers and methane hydrates equal weight in the legal analyses, but in reality the freshwater in offshore aquifers will be exploited much sooner than the freshwater in methane hydrates, due to the fact that the technology for the development of offshore aquifers has been honed by decades of offshore oil and gas production. Production from offshore aquifers does not carry all of the same risks as production of offshore oil and gas. For example, freshwater escaping into the water column from the well will dissipate without the same detrimental impact to the environment as oil and gas. However, the disruptions to flora and fauna in the water column and the seabed emanating from operations will be similar if not identical, and the environmental protections provided under treaties and customary laws will apply with equal force to exploration and extraction activities for offshore aquifers. The impact of development activities relating to methane hydrates is still largely unknown, since only small-scale experiments have been conducted. However, given the seriousness of the worst-case scenarios –- release of heat-trapping methane into the atmosphere and continental shelf destabilization leading to tsunamis – any foray into development of methane hydrates should proceed cautiously and perhaps should be delayed until the consequences are better understood.

When the lack of adequate freshwater supplies has reach a point where extracting offshore freshwater supplies in bulk appears to be a viable, logical solution, one can assume that states may be facing serious, widespread shortages that are threatening civil unrest, compromised ecosystems and declining biodiversity. Therefore, as states contemplate development of offshore freshwater, policy considerations may very well take priority over legal analyses. Since offshore freshwater is not a renewable resource, states will have to determine the timing and extent of extraction and whether short-term needs

take priority over intergenerational equities. Decisions about exploitation may be taken globally, regionally or individually. Policymakers will also have to address the extent to which they will allow damage to their seabeds and the marine flora and fauna in order to meet demands for freshwater and other seabed resources. Integrated ocean management may be fully adopted by then, mandating coordination of all offshore activities including siting of development infrastructure. Offshore aquifers that are hydraulically connected to land-based aquifers may present particular policy dilemmas, since withdrawals from either side will certainly impact both sides. Agreements regarding development of transboundary offshore aquifers may follow the current trends of joint development, or they may become more communal and regional.

Ultimately, states will have to balance their sovereign rights to ownership of offshore freshwater against the growing number of limitations on sovereignty that require protection of the environment, concern for the transboundary effects of development, cooperation with neighboring states and attention to the freshwater needs of citizens of their own states and beyond.[1557] The principle of equitable and reasonable utilization may be merging into the principle of sustainable development[1558], but development can only be sustainable if it does no significant harm to the environment. The effects of exploration and exploitation of seabed resources have been observed and documented through the activities of offshore hydrocarbon development, and thus far states have chosen to proceed with development while accepting sovereign limitations that are mainly procedural and that allow for continued development activities. Where the resource being developed is as critical to terrestrial life as freshwater, one can expect that under current regimes development will take priority over environmental protection. At the same time, one can hope that, in the future when exploitation of offshore freshwater becomes commonplace, humanity will have come to recognize the importance of preserving other

[1557] Virginie Barral, 'National sovereignty over natural resources: Environmental challenges and sustainable development' in Elisa Morgera and Kati Kulovesi (eds), *Research Handbook on International Law and Natural Resources* (Edward Elgar Publishing 2016) 10
[1558] ibid 11, 24

species and providing for future generations, so that the focus in sustainable development will be on sustainability rather than on development.

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