ARCTIC OIL AND GAS DEVELOPMENT: A TRAJECTORY TO ECOLOGICAL RUIN?

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ABSTRACT: *As the Arctic sea ice retreats in response to climate change, vast petroleum resources are becoming technically and economically exploitable. In order to meet the world's growing demand, these resources will almost certainly be developed on a grand scale. However, the Arctic constitutes a particularly hazardous and challenging environment in which to conduct petroleum operations. The region's ecology is especially sensitive and large doubts have been cast over the adequacy of the existing legal regime and the readiness of technologies employed by the industry to cope with such challenges and safeguard the environment. By considering a range of relevant issues, this paper seeks to assess the likelihood that petroleum development in the Arctic will result in ecological ruin. The author concludes that despite some positive steps taken by the Arctic Council, individual governments and oil companies, the Arctic is indeed on a trajectory to ecological ruin. It appears that the timeframe for the development of Arctic resources will outpace the rate at which important technological and regulatory gaps are filled. Such gaps are unlikely to be addressed in a timely manner owing to the weight of commercial interests and political inertia.*

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ABBREVIATIONS

AEPS	Environmental Protection Strategy
BEAR	Barents Euro-Arctic Region
EEZ	Exclusive Economic Zone
MARPOL 73/78	International Convention for the Prevention of Pollution from Ships
OPRC	International Convention on Oil Pollution Preparedness, Response, and Co-operation
OSPAR	Convention for the Protection of the Marine Environment in the North-East Atlantic
PAME	Protection of the Arctic Marine Environment
UNCLOS	United Nations Convention on the Law of the Sea
USGS	United States Geological Survey
WWF	World Wide Fund for Nature

1. Introduction

The Arctic[1] is undergoing profound environmental and economic changes. The effects of climate change are particularly pronounced in Polar Regions, with many areas warming at a rate of 2 to 3 times the global average.[2] The Arctic Ocean is transforming from a permanently ice-covered region to a seasonally ice-free sea. This meltdown is providing shipping, fishing, tourism and petroleum industries with unprecedented access to the region and its lucrative resources.

The United States Geological Survey (USGS) estimates that the Arctic holds 13% of the world's undiscovered oil, 30% of the undiscovered natural gas and 20% of the undiscovered natural gas liquids. These resources "account for about 22% of the undiscovered, technically recoverable resources in the world."[3]

Many analysts speculate that the region will experience an economic boom resulting from the massive infrastructure investments, employment opportunities and novel revenue streams entailed with developing these resources. Major oil giants are already lining up to begin large-scale operations in the region. Robert Blaauw, Senior Arctic Advisor at Shell notes: "*the world's population is set to rise to 9 billion people by 2050, consuming double the energy it does today, of which fossil fuels will contribute 75%. Arctic resources will play a key role in securing our energy future.*"[4]

However, many indigenous and environmental groups harbour growing fears that such development will compromise the integrity of the Arctic environment which is particularly fragile and already subject to discernible anthropogenic pressures. The Deepwater Horizon

[1] There are numerous geographical definitions of the Arctic. Here, for simplicity we consider it to be the region around the North Pole comprising all areas north of the Arctic Circle. Jurisdictionally this includes parts of the sovereign land or marine territory of Canada, Greenland (an autonomous country within the Kingdom of Denmark), Russia, the United States, Iceland, Norway Sweden and Finland. Sweden and Finland do not border the Arctic Ocean and are the only Arctic countries without jurisdictional claims in the Arctic Ocean and adjacent seas.

[2] Sanderson, M.G., *et al*., *Regional temperature and precipitation changes under high-end (≥4°C) global warming*. 369 (1934) Phil. Trans. R. Soc. A 85-98 at p. 85 (2011).

[3] *See* USGS, "*90 Billion Barrels of Oil and 1,670 Trillion Cubic Feet of Natural Gas Assessed in the Arctic*", 23 Jul. 2008, available at: http://www.usgs.gov/newsroom/article.asp?ID=1980 [accessed 10 Jan, 2011].

[4] Personal communication with Robert Blaauw, Senior Arctic Advisor at Shell, in the European Parliament (26 Oct. 2010).

oil spill of 2010[5] serves as a stark reminder to all of the industry's grave and inherent risks. Will the Arctic meet a similar fate or will the region's resources be developed in a more cautious, accident-free manner? What is the current trajectory for the Arctic?

This paper seeks to assess the likelihood that petroleum development in the Arctic will result in ecological ruin.[6] In this pursuit, a number of factors are considered relating to: the sensitivity of the Arctic environment; the impacts of oil and gas activities; risks and challenges that are unique to operating the Arctic; the competence and technological readiness of oil companies that are poised to conduct operations in the region; the envisaged time-frame for petroleum development; the adequacy, coherence and completeness of the existing Arctic legal regime; and the probability of any regulatory gaps being filled in a timely manner. A focus is placed on offshore petroleum activities.

Although they are important topics worthy of further research, owing to length restrictions, this paper does not seek to assess the path dependence of the current trajectory or options for diverting it. Nor does it seek to evaluate the acceptability (ethical or otherwise) of degrading the Arctic environment in order to meet global energy demand.

The author concludes that despite some positive signals relating to the strong pedigree of oil companies that are pioneering the Arctic frontier and the strengthened risk-mitigation measures they are developing, as well as some encouraging steps taken by the Arctic Council to provide guidance to operators, the region is indeed on a trajectory to ecological ruin. This is primarily due to the rushed pace of development, the existence of technological and regulatory gaps and the political inertia to address them. Ultimately however, it is the global demand for petroleum that is the steering the Arctic to ruin.

[5] *See* BP, Deepwater Horizon Accident Investigation Report (n.p.: BP, 2010), available at: http://www.bp.com/liveassets/bp_internet/globalbp/globalbp_uk_english/incident_response/STAGING/local_assets/downloads_pdfs/Deepwater_Horizon_Accident_Investigation_Report.pdf [accessed 15 Jan. 2011]. (pp. 21-30)

[6] For the purposes of this study, 'ecological ruin' is considered to be a severely and irreversibly degraded state of the Arctic environment, in which ecological tipping points have been surpassed, keystone species have been driven to extinction or to threatened conservation status; the system cannot function normally and fails to uphold characteristic ecosystem services that it would otherwise render.

2. Petroleum development in the Arctic environment

Why does the expansion of offshore petroleum activities in the Arctic elicit such concern amongst environmentalists? Is the Arctic really so different from other oil producing regions? Can pioneering oil companies ensure that Arctic petroleum resources are developed in a sustainable manner?

2.1 The sensitivity of the Arctic environment

Far from being a desolate hinterland, the Arctic region is rich in wildlife with globally significant biodiversity. This polar ecosystem is critical to the biological, chemical and physical balance of the planet and is considered to be "more finely attuned and acutely sensitive to environmental impact than… any other part of the globe."[7] This hypersensitivity is due to: extremely low temperatures that retard the breakdown of pollutants and the decomposition of substances; a limited growing season that hinders regeneration; the tendency for Arctic animals to congregate in large dense communities; and climate change being especially pronounced in Polar Regions.[8]

Due to oceanic and atmospheric currents, pollution derived from point sources all over the industrialised world tends to accumulate in the Arctic,[9] augmenting increasingly discernable impacts of climate change, tourism, shipping and fishing. Any consideration of the ecological impacts of Arctic oil and gas development must be made in the context of these additional pressures, both existing and projected, with a view to understanding their cumulative effects.

2.2 Impacts of petroleum development in the Arctic

Offshore petroleum development comprises several stages: 1) geological and geophysical survey; 2) exploration; 3) development and production; and 4) decommissioning. Each stage perturbs the environment, but the third stage gives rise to the "most intense and diverse environmental impacts."[10] Seismic surveys create substantial noise pollution that can deter

[7] McIver, J., *Environmental Protection, Indigenous Rights and the Arctic Council: Rock, Paper, Scissors on the Ice?*, 10 Geo. Int'l Envl. L. Rev. 147 at p. 148 (1997).
[8] Farrens, T.C., *Shrinking Ice, Growing Problems: Why We Must Act Now to Solve Emerging Problems Posed by an Ice-Free Arctic*, 19 Transnat'l L. & Contemp. Probs. 655 at pp. 659-662 (2010).
[9] Rothwell, D.R., *International Law and the Protection of the Arctic Environment*, 44 Int'l & Comp. L. Q. 280 at p. 283 (1995).
[10] Patin, S., Environmental Impact of the Offshore Oil and Gas Industry (NY, USA: EcoMonitor Publishing, 1999). (p. 57)

and damage the hearing of marine mammals.[11] Air emissions from gas-flaring, power generation and well-testing pollute the atmosphere, contribute to climate change, and cause acidification whilst construction and operational discharges can smother habitats, increase water turbulence, poison organisms, and degrade ecological communities.[12] Oil spills resulting from leaks, well blowouts, and shipping accidents can devastate marine life.[13] Oil spills inhibit marine photosynthesis thereby stifling the base of the marine food chain. Gas spills are also ecologically damaging, and can asphyxiate biological organisms and contribute to climate change. Indirect impacts of petroleum development may arise when new infrastructure that is built to support petroleum activities, has an enabling or catalysing effect on other forms of development or resource exploitation such as mining and fishing.

2.3 Challenges and operating risks peculiar to the Arctic

Poor visibility resulting from fog and seasonal darkness as well as shifting ice cover, wandering icebergs, subzero temperatures, high sea states, strong winds, and frequent storms, make Arctic petroleum operations especially challenging. Such characteristics heighten the risk of environmental catastrophe principally by: 1) increasing the likelihood of accidents; and 2) limiting the effectiveness of response measures.

2.4 Pioneering companies and their technological readiness

2.4.1 Timeframe

Arctic fields are thought to contain large proportions of natural gas and natural gas liquids, which are more expensive to extract and transport than oil. However, in the context of escalating demand for oil and gas, it seems unlikely that this economic impediment will preclude the development of Arctic resources at a large scale over the next decade. Indeed, petroleum operations are already well underway in the region (e.g. Alaska, Sakhalin, Baffin Bay, etc). As such, in assessing the technological readiness of companies to conduct Arctic operations, we must consider their existing technologies.

[11] Kremser, U. et al., *Estimating the risk of temporary acoustic threshold shift, caused by hydroacoustic devices, in whales in the Southern Ocean*, 17 (1) Antarctic Science 3 at p. 8 (2005).
[12] *See* Patin, *supra* note 10, at p. 55.
[13] *See id.*, pp. 53-111.

2.4.2 Pedigree

So far national governments appear to be permitting only very experienced companies to explore and exploit Arctic petroleum resources. In November 2010, the Government of Greenland awarded seven exclusive licences for petroleum exploration in the Baffin Bay to generally large and experienced industry players, namely, ConocoPhillips, Shell, Statoil, GDF Suez, Maersk, DONG and Cairn Energy.[14] Russia also appears to be seeking out large experienced companies for developing its Arctic resources as epitomised by the landmark deal between Rosneft and BP of January 2011.[15] Aside from government preferences, this high pedigree of pioneering companies may also be due to the region's characteristics (i.e. lack of infrastructure, high operating costs, distance to markets, etc.) posing insurmountable barriers to smaller, less experienced companies.

2.4.3 Technology and risk mitigation

Alluding to their heightened caution and additional risk mitigation measures, the pioneering companies purport to be well prepared to undertake Arctic operations. In their Greenlandic endeavours, Cairn Energy will deploy patrol ships and tug boats to tow away wayward icebergs,[16] whilst other companies are engaging with leading environmental organisations to seek guidance in minimising their ecological impacts.[17] However, the ability for existing technologies and countermeasure strategies to address oil spills in a real situation in an environment as hostile as the Arctic remains unproven. In deepwater areas, limited transportation and storage facilities, and long distances to onshore infrastructure would create serious logistical problems for cleanup operations. Oil caught beneath sea ice would be virtually inaccessible whilst floating barriers, skimmers and sorbents would work poorly in the open sea in rough conditions.[18] WWF refer to this gap as the "response gap". Former BP

[14] Anonymous, *Greenland Awards Licence Blocks in Baffin Bay*, Oil Voice, 29 Nov. 2010, available at: http://www.oilvoice.com/n/Greenland_Awards_Licence_Blocks_in_Baffin_Bay/1dc1bc3d6.aspx [accessed 10 Jan. 2011]. Note that NUNAOIL, Greenland's National Oil Company, holds an interest in each block.

[15] Finch, J., *et al.*, *Russian oil giant Rosneft buys 5% of BP in Arctic drilling deal*, The Guardian, 15 Jan. 2011, available at: http://www.guardian.co.uk/business/2011/jan/14/bp-rosneft-deal [accessed 16 Jan. 2011].

[16] Byers, M., *It could happen here - Canada should demand a moratorium on Arctic oil drilling until we're certain it will be done safely*, Ottawa Citizen, 6 May 2010, available at: http://byers.typepad.com/arctic/2010/05/it-could-happen-here.html [accessed 2 Feb. 2011].

[17] For example, in 2007 the International Union for Conservation of Nature (IUCN) and Shell signed a 5-year agreement with the purpose of enhancing the company's biodiversity conservation performance. An overview of the agreement is available at: http://liveassets.iucn.getunik.net/downloads/shell_iucn_agreement_key_features.pdf [accessed 6 Feb. 2011]. (pp. 1-4)

[18] Matishov, G.G., *et al.*, *Conservation Problems of Future Arcic Oil and Gas Extraction*, 79 Her. Russ. Acad. Sci. 352 at p. 354 (2009).

Executive, Greg Bourne, warns that imagining current technology and resources could deal with a drilling accident in the Arctic is "a triumph of hope over experience and reason."[19] Similar concerns were raised by the United States Coast Guard Admiral who led the response to the Deepwater Horizon oil spill. He warned that his country is ill-equipped to deal with a major oil catastrophe in the Arctic.[20]

2.4.4 Precedent in the region

Routine pollution and catastrophic accidents corrode the integrity of ecosystems. Every major offshore oil-producing region of the world has suffered, even the relatively safe and advanced operating environment that is the Gulf of Mexico. Will the Arctic, with all its additional dangers avert such doom? Probably not. Already there are ominous indications of what increasing economic activity in the region may entail. In September 2010, a tanker carrying 9 million litres of fuel ran aground in Gjoa Haven in the Northwest Passage, following two similar incidents all within a single month.[21] In 2006, in the Alaskan North Slope Region bordering the Arctic Ocean, a corroded pipeline leaked 1 million litres of oil onto the tundra.[22] In 2010 another pipeline spill occurred in the same region, under similar circumstances.[23] Given that in both cases BP owned major stakes in the pipelines, this repetition raises questions about the industry's resolve to learn from its mistakes.

Considering the potential for Arctic petroleum activities to wreak ecological havoc, the robustness of the regulatory framework governing petroleum operations is of immense significance. Is the Arctic legal regime coherent and complete? If not, then can regulatory gaps be filled in a meaningful timeframe?

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[19] Anonymous, *Oil drilling suspension should top agenda at arctic emergencies meeting*, WWF, 16 Jun. 2011, available at: http://wwf.panda.org/?193848/Oil-drilling-suspension-should-top-agenda-at-arctic-emergencies-meeting [accessed 2 Feb. 2011].

[20] Zeitvogel, K., *US not ready for Arctic oil drilling, say officials*, Physorg, 7 Feb. 2011, available at: http://www.physorg.com/news/2011-02-ready-arctic-oil-drilling.html [accessed 10 Feb. 2011].

[21] Aveling, N., *Fuel Tanker Grounded in Nothwest Passage*, National Post, 2 Sep. 2010, available at: http://news.nationalpost.com/2010/09/02/fuel-tanker-grounded-in-northwest-passage/ [accessed 10 Jan. 2011].

[22] Roach, J. *Alaska Oil Spill Fuels Concerns Over Arctic Wildlife, Future Drilling*, Nat. Geog., 20 May 2006, available at: http://news.nationalgeographic.com/news/2006/03/0320_060320_alaska_oil.html [accessed 5 Jan. 2011].

[23] Rigby, B., *BP-owned Alaska oil pipeline shut after spill*, Reuters, 25 May 2010, available at: http://www.reuters.com/article/2010/05/26/us-alaska-spill-idUSTRE64P04U20100526 [accessed 10 Feb. 2011].

3. The adequacy of the existing legal regime

The Arctic Ocean is governed by national legal regimes, international agreements, soft law arrangements and principles of international law. This section seeks to evaluate the strengths and weaknesses of the most pertinent legal instruments governing Arctic petroleum activities with a view to identifying important regulatory gaps and considering the prospects for addressing such gaps.

3.1 Soft law arrangements

The Arctic Environmental Protection Strategy (AEPS),[24] adopted in 1991, constitutes a first major attempt by the Arctic States to collaboratively conserve the Arctic ecosystem. Aiming to ensure the "protection of the Arctic environment and its sustainable and equitable development," the AEPS contains some basic commitments relating to monitoring, assessment, environmental protection, and emergency preparedness and response measures.

To coordinate the implementation of the AEPS and indeed the broader activities of Arctic States in the region, the Arctic Council was formed in 1996. This high-level intergovernmental forum comprises eight Member States (Canada, Denmark, Finland, Iceland, Norway, Russia, Sweden and the United States), permanent participants and observer organisations. The Council makes decisions by consensus of its members but cannot impose legally binding obligations on them and is devoid of any structural funding or a permanent secretariat.[25] The Norwegian Polar Institute currently hosts a temporary, 3-person Arctic Council Secretariat based on an agreement between the three successive Scandinavian Chairs, Norway, Denmark and Sweden.[26]

The Council's working group on the Protection of the Arctic Marine Environment (PAME) produced the Arctic Offshore Oil and Gas Guidelines[27] which advocate the precautionary principle, the polluter-pays principle and sustainable development whilst prescribing procedures such as environmental impact assessment. Despite highlighting best practices and

[24] Arctic Environmental Protection Strategy, Rovaniemi, 14 Jun. 1991, 30 ILM 1624-1669. pp. 1624-1699
[25] Declaration on the Establishment of the Arctic Council, Ottawa, 19 Sep. 1996, 35 ILM 1382-1390.
[26] Anonymous, *About the Arctic Council*, The Arctic Council, 27 Apr. 2011, available at: http://www.arctic-council.org/index.php/en/about-us/89-resources/about [accessed 31 Oct. 2012].
[27] Arctic Council, Protection of the Arctic Marine Environment Working Group (PAME), Arctic Offshore Oil and Gas Guidelines, (Akureyri, Iceland: PAME, 2009), available at: http://arctic-council.org/filearchive/Arctic%20Offhsore%20Oil%20and%20Gas%20Guidelines%202009.pdf [accessed 15 Jan. 2011]. (pp. 1-98)

fostering common policies, the Guidelines are legally non-binding, and their implementation is not systematically reviewed.

Another intergovernmental forum is the Barents Euro-Arctic Region (BEAR),[28] comprising the Barents Regional Council and the Barents Euro-Arctic Council, and seeking to achieve sustainable development and stability in the region. However, this governance body does not possess a mandate to adopt and enforce legally binding rules, and is limited in terms of membership and geographical coverage.

The aggregate of the soft law arrangements outlined hitherto, afford to the Arctic a very thin layer protection which according to the eminent professor of international law, Philippe Sands, constitutes "a first step" but "ultimately it will be necessary to establish appropriate institutional arrangements and substantive rules… to ensure agreed obligations are respected and enforced."[29] Will Arctic hard law arrangements suffice?

3.2 Hard law arrangements

3.2.1 UNCLOS

The United Nations Convention on the Law of the Sea (UNCLOS)[30] is effectively a constitution for the oceans. It has been ratified by all of the Arctic States except the United States. It governs virtually all marine activities including petroleum exploration and development.[31] UNCLOS establishes maritime zones with different regimes in which coastal, flag, and port States have particular rights and obligations.

Although UNCLOS applies to the Arctic, it does not go so far as to establish a special regime for the region. General provisions in Part XII deal with sources of marine pollution. States have the sovereign right to exploit their natural resources[32] and a duty "to protect and

[28] International Barents Secretariat, The Barents Cooperation (n.p.: International Barents Secretariat, 2012), available at: http://www.barentsinfo.fi/beac/docs/Barents_Cooperation_information_English_March_2012.pdf [accessed 23 Mar. 2013]. (pp. 1-4)
[29] Sands, P., Principles of International Environmental Law, (Cambridge, UK: Cambridge University Press, 2003) (1995). (p. 731)
[30] United Nations Convention of the Law of the Sea, Montego Bay, 10 Dec. 1982, 1833 UNTS 396 (entered into force 16 Nov. 1994) [hereinafter UNCLOS].
[31] *See id.*, article 133(a).
[32] *See id.*, article 193.

preserve the marine environment."[33] States should take a number of measures relating to cooperation,[34] notification,[35] contingency planning,[36] research and information exchange,[37] monitoring,[38] assessment,[39] and reporting.[40] Article 208 stipulates that coastal States should adopt special regulations and take other necessary measures to prevent, reduce and control pollution "arising from or in connection with seabed activities subject to their national jurisdiction." Such regulations and measures "should be no less effective than international rules, standards and recommended practices and procedures."

However, in the context of oil and gas activities, the term, "should be no less effective" is somewhat undermined by an apparent lack of such international rules and standards - even the International Convention for the Prevention of Pollution from Ships (MARPOL 73/78)[41] is not without limitations.[42] UNCLOS provides a general framework for protecting the Arctic environment, but does not provide detailed provisions specifically regulating oil and gas activities. Other limitations of UNCLOS relate to the unresolved issue of whether the Arctic Ocean qualifies as an enclosed or semi-enclosed sea, the implications of which affect regional cooperation obligations.[43] However, perhaps the greatest shortcoming of UNCLOS in protecting the Arctic environment is the lack US participation.

3.2.2 OSPAR

The Convention for the Protection of the Marine Environment in the North-East Atlantic (OSPAR)[44] aims to "to prevent and eliminate marine pollution and to achieve sustainable management of the maritime area."[45] The agreement comprises 15 contracting parties, excluding Canada, Russia and the United States. The geographical coverage of OSPAR is

[33] *See id.*, article 192.
[34] *See id.*, article 197.
[35] *See id.*, article 198.
[36] *See id.*, article 199.
[37] *See id.*, article 200.
[38] *See id.*, article 204.
[39] *See id.*, article 206.
[40] *See id.*, article 205.
[41] International Convention for the Prevention of Pollution from Ships, London, 2 Nov. 1973, as modified by the Protocol of 1978 relating thereto (MARPOL 73/78), 17 Feb. 1978, 1340 UNTS 61 (entered into force 2 Oct. 1983) [hereinafter MARPOL 73/78].
[42] *See* more detailed discussion on this point, *infra*, at 9.
[43] *Supra* note 30, at article 123.
[44] Convention for the Protection of the Marine Environment of the North-East Atlantic, Paris, 22 Sept. 1992, 32 ILM 1072 (entered into force 25 Mar. 1998) [hereinafter OSPAR Convention].
[45] *See id.*, pmbl.

limited to waters in the Atlantic and Arctic Oceans "which lie north of 36 north latitude and between 42 west longitude and 51 east longitude."[46]

OSPAR's supervisory body, the OSPAR Commission, is empowered to adopt binding decisions, recommendations, and "programmes and measures for the prevention and elimination of pollution by limiting activities that may adversely affect the maritime area."[47] In implementing these programmes and measures, contracting parties must apply the polluter pays and precautionary principles, use best practices and techniques, and follow an ecosystem approach.[48] Annex III prohibits the dumping of wastes and other matter from offshore installations and is supported with enforcement provisions. Annex V obliges parties to take "necessary measures to protect the maritime area against the adverse effects of human activities so as to safeguard human health and to conserve marine ecosystems."[49] The OSPAR Commission has produced the Offshore Oil and Gas Industry Strategy,[50] which outlines measures for collecting information about the marine environment, and setting environmental priorities and goals for action.

Although OSPAR constitutes a dynamic, responsive, robust, and enforceable instrument for protecting the marine environment, it is limited in membership and geographical scope. Importantly, Canada, Russia and the United States are not Parties to OSPAR.

3.2.3 MARPOL 73/78

MARPOL 73/78 seeks to eliminate "intentional pollution of the marine environment by oil and other harmful substances and the minimisation of accidental discharge of such substances" from ships.[51] The widely-ratified Convention defines ship as "a vessel of any type, whatsoever, operating in the marine environment and includes… fixed or floating platforms."[52] Thus MARPOL 73/78 regulates offshore petroleum activities.

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[46] *See id.*, article 1(a)(i).
[47] *See id.*, article 10(2)-(3).
[48] *See id.*, article 2.
[49] *See id.*, Annex V, article 2
[50] OSPAR Commission, 2003 Strategies of the OSPAR Commission for the Protection of the Marine Environment of the North-East Atlantic (Bremen: OSPAR, 2003), available at: http://www.ospar.org/html_documents/ospar/html/Revised_OSPAR_Strategies_2003.pdf#nameddest=offshore_o_and_g [accessed 5 Mar. 2011]. (pp. 13-16)
[51] *Supra* note 41, at pmbl.
[52] *See id.*, article 2(4).

MARPOL 73/78 comprises articles dealing with jurisdiction, enforcement and inspection with several annexes setting pollution regulations and discharge limits. If Parties designate a marine zone as a "special area" in accordance with Article 16, then discharge controls are tightened within that area: rigs may only discharge oil if the "content of the discharge without dilution does not exceed 15 parts per million." However, the Arctic Ocean has not been designated special area status and so the level of protection afforded by MARPOL 73/78 to the region is limited.

3.2.4 Other agreements

Various other agreements regulate Arctic petroleum activities, but they have limitations as follows.

- The International Convention on Oil Pollution Preparedness, Response, and Co-operation (OPRC),[53] which aims to "prepare for and respond to an oil pollution incident"[54] has been criticised as inadequately stringent for the Arctic context.[55] Moreover, the OPRC focuses primarily on responding to oil spills rather than averting them and is thus limited in technical scope.
- The 1993 Agreement between Denmark, Finland, Iceland, Norway, and Sweden Concerning Cooperation Measures to Deal with Pollution of the Sea by Oil or Other Harmful Substances[56] compels parties to cooperate "in the protection of the marine environment against pollution of the sea by oil or other harmful substances which present a grave and imminent danger to the material interests of one or more Parties."[57] However, like the OPRC, the 1993 Agreement is also more concerned with oil spill response than aversion, and additionally, this agreement lacks the full participation of Arctic Coastal States.
- The 1983 Canada-Denmark Agreement for Cooperation relating to the Marine Environment (1983 Agreement)[58] is designed to prevent and manage marine pollution

[53] International Convention on Oil Pollution Preparedness, Response and Cooperation, London, 30 Nov. 1990, 1891 UNTS 78 (entered into force 13 May 1995).
[54] *See id.*, article 1.
[55] Casper, K.N., *Oil and Gas Development in the Arctic: Softening of Ice Demands Hardening of International Law*, 49 Nat. Resources J. 825 at p. 852 (2009).
[56] 1993 Agreement Between Denmark, Finland, Iceland, Norway and Sweden Concerning Cooperation in Measures to Deal with Pollution of the Sea by Oil or Other Harmful Substances, Copenhagen, 29 Mar. 2003, 2084 UNTS 324 (entered into force 16 Jan. 1998).
[57] *See id.*, article 1.
[58] 1983 Canada-Denmark Agreement for Cooperation Relating to the Marine Environment, Copenhagen, 26 Aug. 1983, 1348 UNTS 121, *reprinted in* 23 ILM 269 (entered into force 26 Aug. 1983).

in ice-covered areas but suffers, as its name would suggest, from limited membership and small geographical coverage.

3.2.5 Principles of international Law

Several principles of international environmental law apply to offshore petroleum activities in the Arctic. According to Casper, applicable procedural principles include the duties to cooperate, assess risk, notify and inform of risk, consult, and notify, and assist in emergencies.[59] Applicable substantive principles are sovereignty, no harm, precautionary, sustainable development, polluter pays and ecosystem-based management.[60] However these principles are of differing status and enforceability. Sovereignty and 'no harm' are well established in customary international law. The principle of sustainable development is enshrined in the AEPS but whether it constitutes a binding principle is highly debatable. The precautionary principle has become commonplace in international environmental agreements, not least the Rio Declaration on Environment and Development,[61] and appears to be hardening into customary international law. The polluter-pays principle is still not universally recognised and cannot be regarded as binding on Arctic States.[62] Similarly, the principle of ecosystem-based management, which is embedded in OSPAR, cannot yet be regarded as customary international law.

In summary, the Arctic's existing legal regime is patchy, incoherent, and does not afford complete or robust protection to the Arctic marine environment against the dangers of projected petroleum activities. What is the likelihood that these regulatory deficiencies will be addressed in a timely manner? Is a comprehensive agreement in the pipeline?

3.3. Prospects for addressing regulatory gaps

It is unlikely that the regulatory gaps in the Arctic governance regime will be filled in the foreseeable future. The author could find no evidence to suggest that the United States will accede to UNCLOS or that the Arctic Ocean will be elevated to 'special area' status under MARPOL 73/78, or indeed that the geographical scope of OSPAR will be extended. The prospects for a new Arctic treaty appear even slimmer. In 2008, Canada, Denmark, Russia

[59] *Supra* note 55, at p. 855.
[60] *See id.*
[61] United Nations Conference on Environment and Development, Rio de Janeiro, 14 Jun. 1992, Rio Declaration on Environment and Development, Principle 5, UNCED Doc. A/CONF.151.5, 31 ILM 873.
[62] *Supra* note 29, at p. 229.

and the United States issued the Ilulissat Declaration stating that there is "no need to develop a new comprehensive international legal regime to govern the Arctic Ocean," [63] thereby rebuking the calls of many leading scholars, environmental organisations and governance institutions.

Nevertheless, it is worth noting the potential for Arctic States to unilaterally address regulatory gaps within their respective jurisdictions. For example, in 2010, in an effort to improve safety in its Arctic waters, Canada introduced new regulations obliging all large ships to register with coastal authorities.[64]

4. Discussion

Despite the strong pedigree of pioneering companies and the additional precautions which they will take to mitigate risk in the Arctic, precedent suggests that their offshore petroleum activities will inevitably give rise to significant pollution. The technological readiness of pioneering companies to avert a catastrophic oil spill or deal with the consequences of one is questionable.

This should be a serious concern for all Arctic stakeholders. The ecosystem is extremely sensitive and would recover slowly, if at all, from a major pollution incident. Given the sheer magnitude of anticipated oil and gas activities in the Arctic, even routine impacts could amount to considerable ecological damage. This should be considered cumulatively with other environmental pressures such as climate change and the impacts of rapidly expanding fishing, tourism and shipping industries in the region.

The projected speed and scale of economic and environmental change in the Arctic necessitates a robust regulatory framework to safeguard this polar ecosystem. However, the existing Arctic legal regime is patchy and incoherent. Moreover, following the Ilulissat Declaration, the prospects of establishing a new comprehensive agreement are slim.

[63] Arctic Council, The Ilulissat Declaration (Ilulissat, Greenland, 28 May 2008), available at: http://arctic-council.org/filearchive/Ilulissat-declaration.pdf [accessed 10 Feb. 2011]. (p. 2)

[64] Northern Canada Vessel Traffic Services Zone Regulations (SOR/2010-127), CSA, 10 Jun. 2010, available at: http://laws.justice.gc.ca/en/SOR-2010-127/FullText.html [accessed 10 Feb. 2011]. For a brief overview see Bennett, M., *New Canadian Arctic shipping rules may contravene international law*, The World Affairs Blog, 9 Jul. 2010, available at: http://arctic.foreignpolicyblogs.com/2010/07/09/new-canadian-arctic-shipping-rules-may-contravene-international-law/ [accessed 10 Feb. 2011].

4.1 Conclusions

The Arctic does indeed appear to be on a trajectory to ecological ruin. The rate of development appears to be outpacing the advancement of technology and the creation of a comprehensive regulatory regime. Political inertia and commercial interests may be conducive to this trajectory, but ultimately, it is the global demand for petroleum that is steering the Arctic to ruin.

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