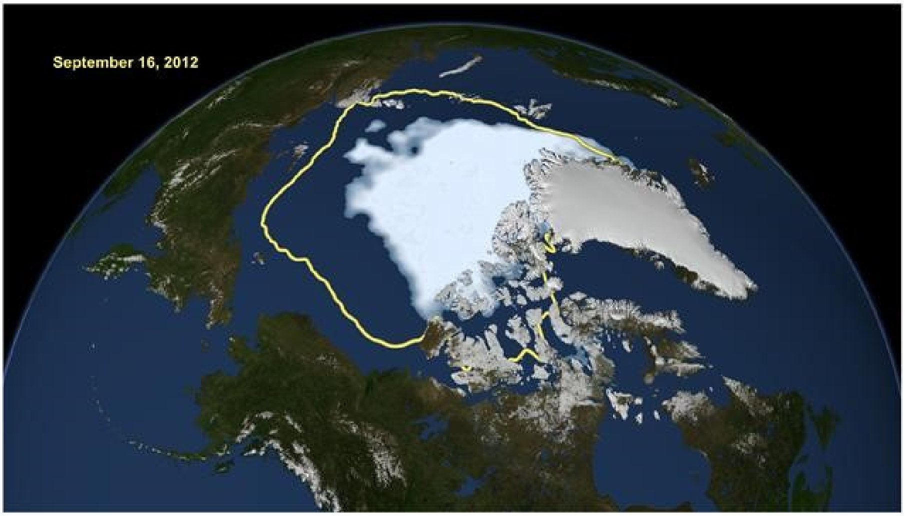
NATO Science for Peace and Security Series - C:
Environmental Security

Environmental Security in the Arctic Ocean



Edited by
Paul Arthur Berkman
Alexander N. Vylegzhanin

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Environmental Security in the Arctic Ocean

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Series C: Environmental Security

Environmental Security in the Arctic Ocean

edited by

Paul Arthur Berkman
Arctic Ocean Geopolitics Programme
Scott Polar Research Institute/Judge Business School
University of Cambridge, United Kingdom

and

Alexander N. Vylegzhanin
Legal Department of the Council for the Study of Productive Resources
Russian Academy of Sciences, Moscow, Russian Federation

Springer

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Cover illustration: The cover image from 16 September 2012 shows the minimum extent of sea ice ever recorded in the Arctic Ocean from satellites, starting in 1979. The Bering Strait to the Pacific Ocean is on the left and Greenland extending into the Atlantic Ocean is on the right side with the Northern Sea Route towards the top and the Northwest Passage towards the bottom of the image. The yellow outline shows the average sea-ice minimum from 1979 through 2010. Analysis of satellite data by the National Aeronautics and Space Administration (NASA) and NASA-supported National Snow and Ice Data Center (NSIDC) indicate that the 2012 sea-ice minimum covered only 3.41 million square kilometers, decreasing more than 750,000 square kilometers (an area larger than Texas) compared to the previous Arctic sea-ice minimum set in September 2007. Moreover, the 2012 sea-ice minimum was 11.83 million square kilometers less than the sea-ice maximum on 20 March 2012, reflecting the environmental state-change from a polar marine system dominated by old multi-year sea ice to a new Arctic Ocean dominated by young first-year sea ice. Overall, the coverage of sea ice in the Arctic Ocean has been diminishing faster than 10% per decade. Sea-ice extent is derived from data captured by the Scanning Multichannel Microwave Radiometer aboard the Nimbus-7 satellite from NASA and the Special Sensor Microwave Imager aboard multiple satellites from the United States Defense Meteorological Satellite Program. NSIDC determined the 16 September 2012 minimum based on a 5-day trailing average of sea-ice extent. This image is generously provided by the NASA Goddard Space Flight Center (GSFC) Scientific Visualization Studio with the Next Generation Blue Marble data courtesy of Reto Stockli (NASA/GSFC) through www.nasaimages.org.

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NATO Advanced Research Workshop Participant Photograph

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Foreword

Like many Canadians I have long had a fascination with the North. Our national DNA is linked to the Arctic, regardless of the fact that the majority of our population lives along our southern border. Its remoteness and wildness leaves us in awe and its significance has weaved itself into the narrative of ourselves as a nation, a sentiment that is surely shared by our Arctic neighbours. Once considered barren and stark, this home of rugged and resourceful Indigenous people, the melting ice has revealed new opportunities for transportation, trade, along with a treasure trove of minerals and fossil fuels. It has also alerted us to the increasing risks brought on by climate change to the security of the people of the North, indeed to the world as a whole. The world is now coming to the Arctic.

Inevitably, the rich economic opportunities that will be made available have stirred up claims of sovereignty and strong unilateral efforts to stake out ownership of the seabed, rather than building on the efforts made in the 1990s to begin forging a cooperative style of governance for the region. Many states outside the Arctic region (e.g., China and the European Union) too are getting into the act and there is, in my opinion, an increasing probability of unrestrained competition bordering on outright conflict. In the meantime, little is being done to respond to the powerful forces of change affecting the people, flora and fauna of the Arctic region.

Regarding the challenges presented by climate change itself, mitigation is not a policy option for those who live in the North, their only option is adaptation. Arctic sea ice is melting faster than originally predicted [2]. Not only will this trend provide Arctic states with access to resources that have heretofore been out of reach, but it will demand a sense of responsibility to the local environment, to the ecology upon which the people and wildlife of the region depend on. The Arctic acts as the canary in the coal mine as far as governing in a world facing a changing climate is concerned.

If we stand by and take no action, the changes will be irreversible. Increased temperatures are causing the Arctic permafrost to melt, releasing methane (a potent greenhouse gas), eroding the coast and threatening the infrastructure already in place. For those living in the North, there are immediate and tangible threats. The Arctic is home to four million people including 30 different Indigenous peoples whose cultures are intrinsically tied to the natural environment. For the Inuit, having populated the Arctic for more than millennia, the ice is the foundation to their cultural practices and their livelihoods. We cannot take them for granted, they represent the human face of territorial sovereignty, and their knowledge of the landscape and their inherent cultural value are inextricable from the context of the high-Arctic. The weather has become illegible for those who live and die by their ability to predict what is to follow, and the sea ice has become unstable, increasing the amount of danger hunters must assume in order to access their prey. These changes do not only translate into threats to the livelihood and security of those living in the North. These changes will have a global impact. As I have heard Sheila Watt-Cloutier say, *"as goes the Arctic, so goes the world."* Significant, meaningful efforts to adapt to these changes are urgently needed while efforts to control emissions stumble to some resolution.

Therefore, it behooves the Arctic coastal states, along with the entirety of the international community to look beyond the antiquated Westphalian mindset and recognize the value of the people and the communities within the borders they are so quick to defend. With the benefits of claiming ownership over rich stores of fossil fuels comes responsibility too. This is where concerns for human security should be considered. For the Inuit individual, human security is far less about boundaries and is significantly more about the ability to live off the land, to hunt, to enjoy their own culture and to ensure that the natural resources they are dependent on remain plentiful for future generations. While it is imperative to mutually agree on territorial borders, it is equally urgent for all Arctic stakeholders to engage in serious dialogue around what constitute common security threats to the region.

Recognizing these changes demands a new perspective on how best to secure the region and to negotiate an uncharted terrain on sovereignty. This is an opportunity, as we are but in the early stages of developing new norms in how to govern cooperatively. This includes both determining what role is to be played by various state and non-state actors. More specifically, how to best use our military resources considering the strained, but mostly cooperative, approach that tends to characterize state to state relations? Alternatively, how to delineate the participatory role that is to be played by Indigenous groups?

These concerns are all encompassed within Paul Berkman's (2010) definition of environmental security: *"an integrated approach for assessing and responding to the risks as well as the opportunities generated by an environmental state-change."* Any effort to balance the economic benefits with the security context within the Arctic will require a coordinated, multi-level approach. One that will require both the foresight to address the challenges that we currently face on the ground with the changing climate, but also the ability to look ahead to prevent any future crisis, all the while respecting the right of Indigenous peoples in meaningful ways. In an appeal to the precautionary principle, an event such as the oil spill that occurred in the Gulf of Mexico in the spring of 2010 should be avoided at all costs. While there is wealth to be gained, due diligence must be a priority within the context of the Arctic's fragile ecosystem.

Identifying opportunities for cooperation in addressing security concerns is imperative. I would argue that this type of governance has already begun to take shape in the Arctic, starting with the creation of the Arctic Council in 1996. This high-level forum for promoting cooperation and coordination among the Arctic states peoples, particularly on environmental protection and sustainable development, was the product of several years of painstaking diplomatic work by a small band of Inuit leaders and national policy makers within the circumpolar region who saw the need to address serious Arctic issues in a collegial way. What made the Arctic council different from other regional, multi-lateral organizations was the inclusion of Indigenous groups as permanent members, providing for the possibility for a more inclusive decision-making process and governance.

To date, the Council has excelled at producing reports on climate change as well as human development in the Arctic. In 2009, it produced the Arctic Marine Shipping Assessment [1], which drew international attention to the dearth of search and rescue coordination. With the exponential growth in mineral exploration and new mines in Nunavut, the potential for substantially increased amounts of freight and fuel to that territory is assured, increasing the amount of traffic in the Passage. The tanker and cruise ship that ran aground last summer points to the concern that only 10 % of Arctic waters in the Northwest Passage have been charted and mapped [1]. This not only makes navigation that much more of a precarious operation and it puts people's lives at risk and there is a potential threat to coastal ecosystems if there is a spill.

In May 2011, the state members of the Arctic Council signed a search and rescue agreement [4]. This is a significant and necessary undertaking as the coordination of rescue operations have to date been sorely under-addressed. It is also a significant step forward for the Arctic Council mandate. When the *Ottawa Declaration* [7] was signed, this founding document to the Arctic Council expressed commitment to provide an international forum drawing attention to the environmental and social challenges faced by both Arctic peoples and states. The Declaration also intentionally left out any considerations or concerns regarding the use of the Council to address matters of security or coordinating a role for any military forces. That was a clear condition for American support for the Council. The shift toward coordinating a search and rescue response represents a significant step forward in the Arctic Council's authority as the primary forum regarding the governance of the Arctic.

The topic of search and rescue is only one component of what must be an increasing focus on governance – energy security, environmental protection and the rights of Indigenous peoples, to name a few. There is an obvious demand for more effective means of international teamwork to meet the challenges of Arctic governance. The philosophy of go-it-alone is alive and well even in the face of shared risks that are unequivocal. Traditional notions of national sovereignty are stoutly defended even while the tempo of interdependence is under way.

A new strategy for Arctic governance must encompass a shift in consciousness toward networks, and the recognition that the challenges of the region are not limited to national concerns and cannot be addressed by the governments of any one nation. These are challenges that require broader awareness, international co-operation and innovative ideas. Will we continue to follow the map drawn by those who see the world divided, carved up by boundaries and seized with a fortress mentality? Or, are we ready to draw a new course, one that brings the broad spectrum of Arctic interests and perspectives together to develop solutions to the shared challenges in the region?

This includes respecting and encouraging the role of Indigenous communities in the sovereignty discussion. While the Arctic-5 states should be commended for signing the *Ilulissat Declaration* [3], committing to move forward cooperatively and within the current international legal framework, that specific forum is exclusionary and any of its outcomes represent only a limited voice. The Inuit themselves are sensitive to the possibility of being left out of the decision-making process, exemplified by the release of the *Declaration on Sovereignty in the Arctic* by the Inuit Circumpolar Council in 2009. Instead of a conflicting relationship, Arctic states should recognize the invaluable role that Indigenous groups can play in not only enhancing sovereignty, but also by balancing the more steadfast territorial ambitions of nation state-only inspired governance. As an example, in Canada, a significant component of search and rescue operations are the Northern Rangers, a network of Inuit community members with special training and an innate knowledge of the land, who can act as first responders in crisis situations.

Organizations like the Arctic Council represent the evolution of just the type of cooperative, collegial institutional thinking that is necessary. They recognize the need for a global public domain in the North to protect the way of life of the Indigenous peoples, to guard the fragile environment, and to effectively respond to the new economic opportunities. To date, the Arctic Council has been particularly effective in generating policy-relevant knowledge about the Arctic region, and in shining a spotlight on Arctic issues at international forums. There already exists a prototype for collaborative governance. It was the first multilateral institution that had Indigenous peoples at the table, along with all circumpolar countries.

This all relates to a subject on which I have written about before. I referred to it as *"network governance"* [5]. It is a tool that recognizes and allows all stakeholders to be part of the decision-making process. It acknowledges that while international affairs remains entrenched in the role of the state, there is recognition that this system finds governing complex trans-border security issues a challenge. Such challenges are the norm in the Arctic. There is a push, therefore, to support collaboration across national boundaries, promote multinational use of best management practices as well as adoption of successful protocols developed by the world's best experts. The Arctic Council is already proving to be an example of the approach.

Ultimately, a precedent of cooperation is being established, and while there is much to lose, there is significantly much more to be gained and preserved through active negotiations, and collaboration guided by common interests and goals, which outnumber disputes. And negotiations are progressing; last spring, Russia and Norway successfully and peacefully negotiated the end to a 40-year dispute over a section of the Barents Sea. Denmark and Canada are negotiating through their dispute over all 1.30 square-kilometers of Hans Island, and are participating in a joint mapping project.

As in the case with the Antarctic, the Arctic should be a region of diplomacy and cooperation. A new, all-encompassing treaty for the Arctic is not necessarily the answer, but new policies could be developed in the context of frameworks in cooperation with the Arctic Council, non-governmental organizations (NGOs), scientists and Indigenous peoples. The current United States administration has expressed interest in ratifying the *United Nations Convention on the Law of the Sea* [8], which would be a welcome change. The North represents our future. It is time we began to approach the region and its people with an internationalist vision that we know from recent experience can work.

As we are in the earliest phases of charting new pathways through the maze of security issues that will need to be addressed, any approach to addressing the future environmental security needs of the Arctic will need to be innovative. The greatest outcomes will benefit from collaborative, diplomatic efforts and will continue to include the input of Indigenous peoples. Such a culturally, economically and environmentally rich region such as the Arctic should warrant as much.

Lloyd N. Axworthy
President and Vice Chancellor, University of Winnipeg
and Former Foreign Minister of Canada

Office of the President, University of Winnipeg
515 Portage Avenue, Winnipeg MB R38, Canada

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Preface: International, Interdisciplinary and Inclusive Perspectives

I Background

This book results from the North Atlantic Treaty Organization (NATO) Advanced Research Workshop (ARW) on *Environmental Security in the Arctic Ocean* that was convened in the Scott Polar Research Institute at the University of Cambridge in October 2010 (Appendix 1). Funding for this workshop – reflecting its unbiased solution-oriented focus – was provided by the NATO Science for Peace and Security Programme along with the: Aspen Institute Dialogue and Commission on Arctic Climate Change; Canadian Polar Commission; John Sloan Dickey Center for International Understanding at Dartmouth College; NATO Parliamentary Assembly; Shell International Exploration and Production B.V.; and WWF International Arctic Programme.

The ARW involved diplomats, scientists, legislators, administrators, corporate executives, students and other members of civil society from 17 nations, including all of the Arctic states, and from the Arctic indigenous peoples organizations (Appendix 2). Participants in the ARW shared comments in their personal capacities in eight thematic sessions with three keynote addresses in each session followed by a moderated panel discussion. Organization of this book follows from these ARW presentations, with chapters from the keynote presenters as well as several invitees who were unable to attend. All chapters were reviewed by at least two experts and revised based on their anonymous comments. Key points from the workshop presentations and discussions were captured in the NATO-ARW final report and incorporated into the conclusions of this book, revealing options for decision makers to consider while refraining from advocacy of recommendations. In addition, the *Agreement on Cooperation on Aeronautical and Maritime Search and Rescue in the Arctic* (signed in Nuuk, Greenland, in conjunction with the May 2011 Arctic Council ministerial meeting) is included because it is the first legally binding pan-Arctic agreement among all eight Arctic states (Appendix 3) with global relevance to shipping and other economic activities in the high North.

This co-edited book reflects progress with NATO and Russia to build an ongoing dialogue and overcome long-standing distrust with regard to security issues in the

Arctic. As described by chapters in this book, the NATO-ARW enabled diverse experts to openly share insights – revealing international, interdisciplinary and inclusive perspectives on the histories, needs and policies that underlie common interests in the Arctic Ocean.

II Arctic Ocean System

This book relates to the Arctic Ocean specifically rather than the broader Arctic region as defined in the *Arctic Human Development Report* [2]. Starting from first principles – the Arctic Ocean can be considered as a system bounded by the sea floor, permanent sea-ice cap and surrounding land areas with inflow and outflow from the North Pacific as well as the North Atlantic (Fig. 1). Seasonal solar forcing is influenced by tilt of the

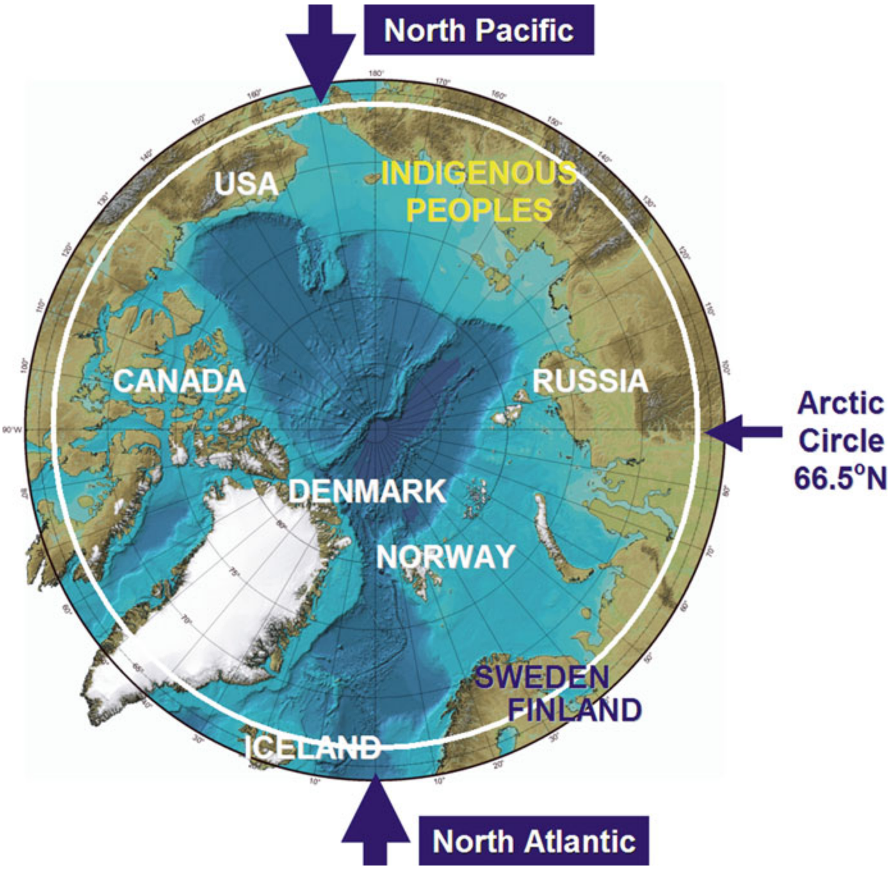

Fig. 1 Generalized view of the Arctic Ocean system bounded by the sea floor [7], surrounding continents and sea ice on the surface with inflow and outflow from the North Pacific and North Atlantic, directly impacting Arctic marine ecosystems as well as adjacent coastal states (*white*), non-coastal states (*blue*) and circumpolar indigenous peoples (*yellow*) north of the Arctic Circle at 66.5° North latitude (*white circle*)

Earth's axis, which is why the Arctic Circle is at 66.5° North latitude, providing an unambiguous astronomical boundary to delimit the Arctic Ocean. Oceanography and meteorology of the Arctic Ocean directly influence natural ecosystems and adjacent human populations of indigenous peoples and surrounding coastal states of Norway, Denmark, Canada, United States, Russian Federation and Iceland as well as the non-coastal Arctic states of Sweden and Finland.

Historically, the Arctic Ocean has been characterized by its sea ice that accretes over many years and which has persisted year-round, possibly as long as 800,000 years [11] or even over millions of years [15]. This has changed.

Within our lifetime, the Arctic Ocean has transformed from a permanent sea-ice cap to a seasonally ice-free sea. Rather than projecting out to the mid-twenty-first century when the Arctic Ocean may be open water across the North Pole [5], we can see that the system already has crossed the threshold with more than 50 % of the sea ice newly forming each year (Fig. 2). Moreover – as recognized during the middle of the winter – there is first year sea ice from the Bering Strait to the Barents Sea. Like a fertile area becoming a desert or a glacier becoming a mountain valley, the Arctic Ocean is experiencing an environmental state-change where the boundary conditions and dynamics of the system are fundamentally replaced [13]. In fact, the Arctic Ocean is undergoing the largest environmental state-change on Earth.

Removing the sea ice cap fundamentally alters the dynamics of this Arctic Ocean system. Like removing your office ceiling, which would dramatically alter your inside behaviors – the fundamental shift in the sea-surface boundary of the Arctic Ocean is creating a new natural system with different dynamics than anything previously experienced by humans in the region.

Interests in the Arctic Ocean extend most immediately from the surrounding stakeholders and rights holders – Arctic states and indigenous peoples – to the non-Arctic states and global civil society more generally (Fig. 3). The challenge is to reconcile and harmonize these diverse interests in a manner that promotes sustainable development of the Arctic Ocean – balancing environmental protection, economic prosperity and social equity with local, regional and global implications. Importance of such balance is reinforced by insights generated from the World Commission on Environmental Development that established sustainable development as a "common global issue" [16]:

> *Environment must also be an approach to development. Environment is a social justice issue and environment even is a peace and security issue.*

It is for these reasons, with urgency, that environmental security ([3] Box 1) is being considered in the Arctic Ocean.

Box 32.1

Environmental security is defined herein as an integrated approach for assessing and responding to the risks as well as the opportunities generated by an environmental state-change.

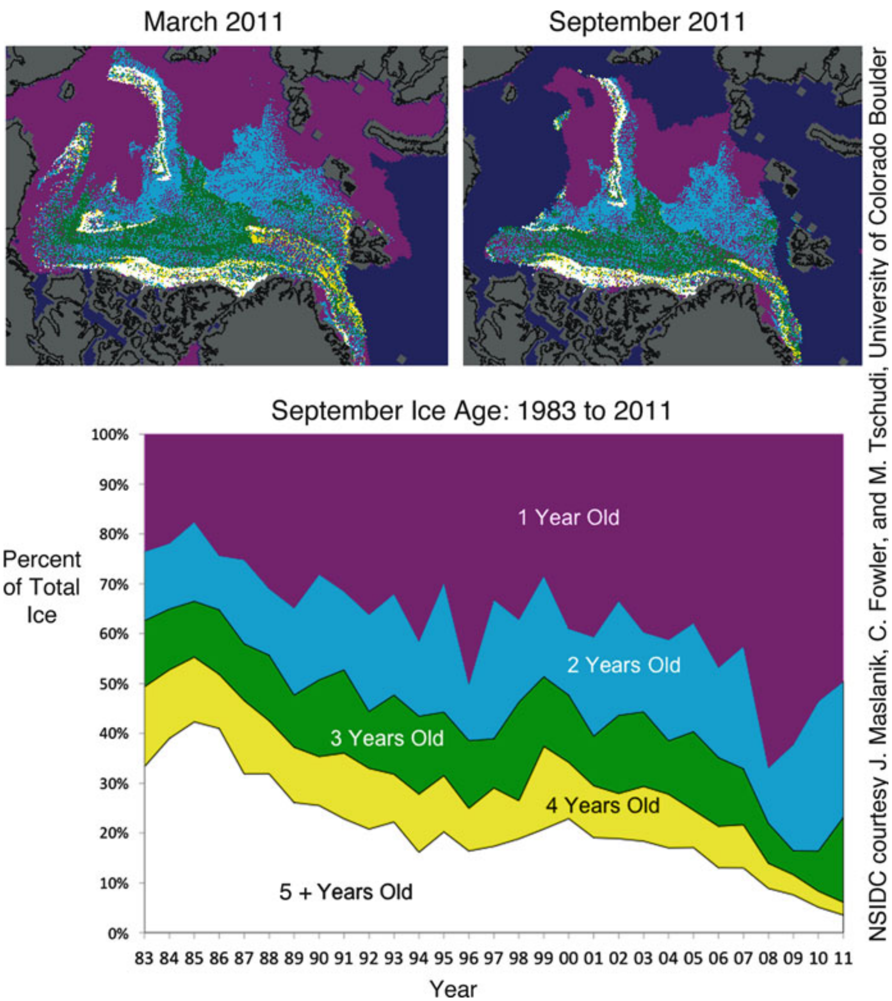

Fig. 2 Environmental state-change in the Arctic Ocean system (Fig. 1) associated with the diminishing sea ice boundary, as reflected by multi-year sea ice being replaced by first-year sea ice from 1983 to 2011 [9]. It is noteworthy that open water now predominates during the summer along the Russian coast and sea ice during the winter is mostly less than 1 year old from the Bering Strait to the Barents Sea. In contrast, most of the multi-year sea ice in the Arctic Ocean remains adjacent to the North American coast

Looking back, the late 1980s also was a time when the world was emerging from the Cold War, opening a new era of cooperation when it would become possible to address "common Arctic issues." As observed by Soviet President Mikhail Gorbachev [4] in his seminal Murmansk speech:

> *The potential of contemporary civilization could permit us to make the Arctic habitable for the benefit of the national economies and other human interests of the near-Arctic states, for Europe and the entire international community. To achieve this, security problems that have accumulated in the area should be resolved above all.*

Fig. 3 Concentric levels of responsibilities to manage human activities in the Arctic Ocean. The Arctic coastal states, Arctic non-coastal states and six indigenous peoples organizations (Fig. 1) were original signatories to the *Ottawa Declaration* [10] that established the Arctic Council. Interactions with non-Arctic states and non-state actors, especially industry, reflect the interplay of global civil society in the Arctic Ocean [3]

Moreover, President Gorbachev (1987) recognized the underlying urgency of sustainable development for the Arctic, as reflected by his timeless imperative:

> *Let the North of the globe, the Arctic, become a zone of peace. Let the North Pole be a pole of peace.*

III Objectives

Stability and stewardship are at the heart of the emerging dialogue about the Arctic Ocean that will become increasingly relevant to humankind in the twenty-first century and beyond. In view of the environmental state-change in the Arctic Ocean, from a permanent sea-ice cap to a seasonally ice-free sea, objectives of this book are:

1. Openly and objectively address potential instabilities and opportunities that are emerging in the Arctic Ocean as matters of environmental security

2. Facilitate international, interdisciplinary and inclusive dialogues that continuously build trust among all Arctic states, indigenous peoples and other stakeholders to resolve Arctic Ocean issues
3. Consider strategies that both promote cooperation and prevent conflict in the Arctic Ocean with balanced stewardship for the lasting benefit of all

Up front, the purpose of this book is not to address military security issues, even though NATO is a military alliance. Rather, the ARW and this book – originating with support from the NATO Science for Peace and Security Programme – seek to facilitate holistic dialogues about environmental security that:

Phase 1. Engender *common understanding* of the risks of political, economic and cultural instabilities emanating from the environmental state-change in the Arctic Ocean

Phase 2. Build *common acceptance* of the integrated infrastructures to mitigate the instability risks

Phase 3. Reveal policy pathways to support the sustainable implementation of the integrated infrastructures based on *common agreement*

It is recognized that each of these phases is increasingly complicated in terms of commitments and resource allocations. The ARW and this book are intended only to contribute to the first phase of these holistic dialogues.

Even though the *"crucial role of the United States and Russia for Arctic stability and prosperity"* had been recognized – previous NATO meetings to explore *"issues that could be construed as dimensions of future Arctic security"* were conducted without Russian participation [6]. The ARW co-directors and editors of this book are from a NATO country and the Russian Federation, creating an important bridge to consider security issues in the Arctic Ocean through a shared dialogue that has not been pursued previously. Subsequent involvement of Russian lawmakers in the Rose-Roth Seminar on *Changes in the High North* in Tromsø in June 2011, which was convened by the Norwegian Storting and NATO Parliamentary Assembly [8], represents additional progress between NATO and Russia to share perspectives about the Arctic.

Contemporary relevance of open, ongoing and inclusive dialogues about security issues in the Arctic is reflected in the comments from Russian Prime Minister Vladimir Putin [12], when he spoke about common responsibility and the need for *"genuine partnership in the economy, security, science, education and the preservation of the North's cultural heritage."* Prime Minister Putin (2010) further emphasized that:

> *preserving the Arctic as a zone of peace and cooperation is of the utmost importance.*

The opportunity with *Environmental Security in the Arctic Ocean* is to build on the *"common arctic issues"* of sustainable development and environmental protection [10] with synergy, vision and hope to preserve the Arctic Ocean as a zone of stability and peaceful uses for the lasting benefit of all.

University of Cambridge — Paul Arthur Berkman
Russian Academy of Sciences — Alexander N. Vylegzhanin

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About the Authors

Raymond V. Arnaudo serves on the United States Secretary of State's Policy Planning Staff. Mr. Arnaudo has over 30 years experience in environmental and science policy affairs with the US government. Before becoming a member of the Secretary of State's Policy Planning Staff, he was the Head of the United States Antarctic Treaty Secretariat, and prior to this, was the Senior Advisor for nuclear energy and multilateral nuclear nonproliferation with the Department of Energy at the American Embassy in Moscow from 2006 to 2008. He was the Deputy Director of the Office of Oceans Affairs before that, and has a long history of work in oceans and polar affairs, including serving as the Department of State lead Arctic negotiator during the formative period of Arctic cooperation during the 1980s and 1990s, including as lead for the United States to negotiate the *Arctic Environmental Protection Strategy* and later the Arctic Council. He was the Chairman of the Arctic Council in 1998–2000. He has also been the Science and Environment Counselor at the American Embassy in London, United Kingdom and the United States Permanent Representative to the United Nations International Maritime Organization. Arnaudo received his B.A. degree from Stanford University and his M.A. from the John Hopkins School of Advanced International Studies. He has served in the United States military and is a native San Franciscan.

Dr. Kristian Åtland is a senior analyst with the Norwegian Defense Research Establishment, located at Kjeller, Norway. He holds a Ph.D. in political science from the University of Tromsø. In 2007–2008, he was a Fulbright visiting scholar at the University of California, Berkeley. Dr. Åtland also is affiliated with the *Geopolitics in the High North* program, a 5-year (2008–2012) research program administered by the Norwegian Research Council. Centering on Arctic security issues, his previous publications have appeared, inter alia, in *Cooperation and Conflict*, *Journal of Slavic Military Studies*, *Armed Forces & Society*, *European Security*, *Security Dialogue* and *Contemporary Security Policy*.

Hon. Lloyd N. Axworthy, President and Vice-Chancellor of The University of Winnipeg, served as Canada's Minister of Foreign Affairs from 1996 to 2000. In the Foreign Affairs portfolio, Minister Axworthy became internationally known for his advancement of the human security concept, in particular, the *Ottawa Treaty* – a landmark global treaty banning anti-personnel landmines. Prof. Axworthy currently serves as a commissioner on the Aspen Institute's Dialogue and Commission on Arctic Climate Change. He is a Board member of the MacArthur Foundation, Human Rights Watch, the Educational Policy Institute, the Canadian Landmines Foundation and the University of the Arctic, among others.

Dr. Yannick Christian Beaudoin is the Head of Marine at the United Nations Environmental Programme (UNEP) GRID-Arendal. His current project work activities include management of the UNEP *Global Outlook on Methane Gas Hydrates* and co-coordination of the Secretariat of the Pacific Community (SPC) Applied Geoscience and Technology Division for the UNEP *Pacific Marine Minerals and Deep Sea Mining Assessment*. He is also a lead geoscientist with the UNEP Shelf Programme, coordinated by GRID-Arendal, which has been providing technical assistance to developing states working to delineate the outer limits of their continental shelf according to criteria outlined in Article 76 of the *United Nations Convention on the Law of the Sea.* His background includes a Ph.D. in Marine Economic Geology with a special focus on deep-sea hydrothermal systems.

Prof. Paul Arthur Berkman is a Research Professor in the Donald Bren School of Environmental Science and Management at the University of California Santa Barbara and former Head of the Arctic Ocean Geopolitics Programme through the Scott Polar Research Institute and Judge Business School at the University of Cambridge. He is an interdisciplinary oceanographer who is establishing connections between science, policy and information technology to promote cooperation and prevent discord for good governance of the Arctic Ocean, Antarctica and international spaces more generally. In 2009, he chaired the *Antarctic Treaty Summit* in Washington, DC on the 50th anniversary of the Antarctic Treaty involving 40 sponsoring institutions from around the world (www.atsummit50.aq) and he is a Director of the Foundation for the Good Governance of International Spaces that emerged as a Summit legacy. Paul serves as a principal investigator on the *Arctic Climate Change, Economy and Society* (ACCESS) project funded by the European Commission from 2011 to 2015. Among his authored and co-edited books are: *Science Diplomacy: Antarctica, Science and the Governance of International Spaces* (2011); *Environmental Security in the Arctic Ocean: Promoting Cooperation and Preventing Conflict* (2010); and *Science into Policy: Global Lessons from Antarctica* (2002). Prof. Berkman has received the: Antarctic Service Medal from the United States Congress; National Aeronautics and Space Administration (NASA) Faculty Fellowship at the Jet Propulsion Laboratory, California Institute of Technology; Byrd Fellowship at Ohio State University; Japan Society for the Promotion of Science Fellowship at the National Institute of Polar Research in Japan; Erskine Fellowship in the Gateway Antarctica, University of Canterbury in New Zealand; and Fulbright Distinguished Scholarship at the University of Cambridge in the UK. Paul has a master's degree and doctorate in biological oceanography from the University of Rhode Island, where he was a National Science Foundation Graduate Fellow. Prior to graduate school, Paul wintered in Antarctica, where he conducted SCUBA research throughout the year, leading to his Visiting Professorship at the University of California Los Angeles in 1982. In 2011, he was elected to the Norwegian Scientific Academy for Polar Research.

Steven C. Bigras joined the Canadian Polar Commission in August of 1999 as its first Executive Director. A 20-year veteran of the Canadian federal government, Bigras worked as a senior manager, with the department of Indian and Northern Affairs Canada, specializing in circumpolar and scientific affairs and economic development. He was responsible for the development and management of national programs in support of northern science and technology, and commercial opportunities. As a hydrologist with Environment Canada, he managed national and regional river ice and lake regime studies in the Arctic and authored numerous papers. Bigras is a member of numerous national and international polar research advisory bodies.

Robert J. Blaauw is the Senior Advisor Global Arctic Theme for Shell International Exploration and Production BV in the Netherlands. Robert joined Shell in 1980. He started in technical and operational functions and thereafter moved to commercial and general management roles in Shell operating companies in the Middle East, Africa, Asia and Australia. In 2002, Robert moved to Shell's corporate headquarters in The Netherlands, where he was Business Development Manager for the Caspian, Middle East and later Russia. During the last few years, Robert started pulling together Arctic capabilities (technical, social, environmental and communications) on a pan-Arctic scale and since end 2009 he is managing the Global Arctic Theme for Shell on a full-time basis. This includes working with strategic partners in support of Shell's license to operate in the Arctic and work with industry associations to improve global industry standards in the Arctic. Robert grew up in The Hague and studied at the Technical University Delft where he received an M.Sc. in Civil Engineering.

Nikolaj Bock has been a Special Adviser on International Affairs at the Executive Director's Office in the European Environment Agency (EEA) since 2009 with the task of strengthening EEA's international relations and in particular with regard to the Arctic environmental and cooperation with the Arctic Council. Prior to this position, Bock was Senior Adviser at the Nordic Council of Ministers (2005–2009) with responsibility for coordinating the work of the Nordic Ministers for the Environment and the Arctic cooperation by the Ministers of Nordic Cooperation, including organizing the conference: *Common Concern for the Arctic* held in Greenland in 2008. Bock has also held positions as Head of Section in the Royal Danish Ministry of Foreign Affairs from 2001 to 2004 working with development aid, bilateral relations and Nordic corporation and as First Secretary at the European Union Delegation in the Solomon Islands (2000) with responsibility for EU development aid and reporting on foreign and security matters during the civil war in the Solomon Islands. Bock held a position as Assistant Policy Adviser in the United Kingdom Department of Environment, Transport and the Regions (1999), which involved implementing European Union environmental legislation. He also served as Executive Officer in the United Kingdom Ministry of Agriculture, Fisheries and

Food (1998) working with sustainable agriculture. Prior to this, Bock was trainee in the Environment Directorate-General for the European Commission (1997). Bock has an M.A. from the University of Copenhagen majoring in European Union Environmental Policy (1997).

Prof. Lawson W. Brigham is Distinguished Professor of Geography and Arctic Policy at the University of Alaska Fairbanks and a Senior Fellow at the Institute of the North in Anchorage. During 2005–2009 he was chair and United States co-lead for the Arctic Council's *Arctic Marine Shipping Assessment* and Vice Chair of the Council's working group *Protection of the Arctic Marine Environment*. Prof. Brigham was a career United States Coast Guard officer and commanded icebreakers on the Great Lakes and in Arctic and Antarctic waters. He was a research fellow at Woods Hole Oceanographic Institution, a faculty member of the United States Coast Guard Academy and the Naval Postgraduate School, and Alaska Office Director of the United States Arctic Research Commission. He is a graduate of the United States Coast Guard Academy (B.S.), a distinguished graduate of the Naval War College, and holds graduate degrees from Rensselaer Polytechnic Institute (M.S.) and the University of Cambridge (M.Phil. and Ph.D.). His research interests for more than three decades have focused on the Russian maritime Arctic, Arctic climate change, polar environmental protection and polar geopolitics.

Dr. Ivan V. Bunik is Head of the Section of the Law Research Center of the Council for Research of Productive Resources (SOPS), Russian Academy of Sciences. Ivan Bunik is a graduate of the Moscow State Lomonosov University, Law Department. He obtained a Ph.D. in International Law by the Moscow State Institute of International Relations (MGIMO-University) with the Ministry of Foreign Affairs of the Russian Federation. He specializes in public law and international law with experience in acting as legal counsel for a number of international organizations in Russia, including the: United Nations Environment Programme (UNEP), Global Environment Facility (GEF), Interstate Aviation Committee (IAC) and Regional Commonwealth in the field of Communications (RCC). He also works with governmental bodies of the Russia Federation, including the: Ministry for Economic Development; Ministry of Natural Resources; and Ministry of Education and Science. He also works with major national and foreign companies. Ivan Bunik was among a group of experts engaged in drafting the Law of the Russian Federation "*On the Northern Sea Route.*" He has acted as adviser to the Commission on national sea politics of the Council of Federation (the upper house of the Russian Parliament). Dr. Bunik is a co-author of MGIMO-University textbook of 2007 entitled *International Legal Basics of Subsoil*, recommended by the Ministry of Education of the Russian Federation as a textbook for students studying jurisprudence, international relations and world economy disciplines. In 2008, Dr. Bunik became a member of the Editorial Board of the *International Energy Law Review*. He is a member of the Russian Association of International Law.

Sandra Cavalieri is a Fellow and Coordinator for the Arctic and Transatlantic Programs at Ecologic Institute. Her work focuses on developing policy and adaptation strategies in the Arctic environment through stakeholder-based dialogue. Key focal areas of her work include: environmental governance, traditional knowledge and indigenous peoples, fisheries management, maritime shipping and offshore hydrocarbon exploration in the Arctic region.

Hon. Arturo Nikolayevich Chilingarov serves as Special Representative of the President of the Russian Federation for International Cooperation in the Arctic and Antarctic. He is a Russian polar explorer and a corresponding member of the Russian Academy of Sciences. Chilingarov also is a member of State Duma from Nenets Autonomous Okrug since 1993. His extensive research background began in the early 1960s, when he graduated from the Arctic faculty of the Leningrad Maritime Institute, and includes heading the: drift ice station *"North Pole-19"* in 1969, Bellingshausen Station of the 17th Soviet Antarctic Expedition in 1971; the Amderma Administration of hydrometeorology in the western sector of the Arctic from 1974 to 1979; and special expedition on the research vessel *Mikhail Somov* that was ice-blocked in the Southern Ocean in 1985. For successful performance of salvation operations in extreme conditions and shown organizational abilities and courage, Dr. Chilingarov was awarded the title Hero of the Soviet Union on February 14, 1986. In 2007, he was accompanied by five other explorers from different countries, when he descended in the *Mir* submersible 13,980 feet below the surface of the Arctic Ocean to plant a Russian flag on the sea floor at the North Pole. In 2008, Chiligarov was awarded the title Hero of the Russian Federation *for "courage and heroism showed in extremal conditions and successful completion of the High-Latitude Arctic Deep-Water Expedition."* Among his many national and international honours, Dr. Chilingarov was also awarded the Chevalier Legion of Honour from France in 2010.

Patricia A.L. Cochran was born and raised in Nome, Alaska. Ms. Cochran serves as Executive Director of the Alaska Native Science Commission, an organization that brings together research and science in partnership with Alaska Native communities. Ms. Cochran also served as Chair of the 2009 *Indigenous Peoples' Global Summit on Climate Change* and is Co-Chair of the *Indigenous Peoples' Global Network on Climate Change*. She is the past Chair of the Inuit Circumpolar Council (ICC), an international organization representing 160,000 Inuit of Alaska, Canada, Russian and Greenland; and former Chair of the Indigenous Peoples' Secretariat to the Arctic Council.

Dr. Robert W. Corell is a Principal at the Global Environment Technology Foundation (GETF) and Professor II at two universities in Norway. He chaired the *Arctic Climate Impact Assessment*. He is actively engaged in research concerned with the sciences of global change and the interface between science and public policy. He was until 2000 the Assistant Director for Geosciences at the National Science Foundation where he had oversight for all the Earth-related sciences and chaired the US global change programs. He is an oceanographer and engineer, having received Ph.D., M.S. and B.S. degrees at Case Western Reserve University and Massachusetts Institute of Technology.

Dr. Heike Deggim joined the International Maritime Organization (IMO) in September 1993, having worked in the naval shipbuilding industry and later in various positions in the German maritime administration after graduating from Rostock University in marine engineering in 1983. Her duties in IMO included the running of the Sub-Committee on Flag State Implementation (FSI) and also the implementation of various maritime safety related technical co-operation projects, mainly in the Caribbean and in the Asia/Pacific region. Later she took over as Secretary of the Sub-Committee on Ship Design and Equipment, which deals mainly with ship construction related matters such as design, hull construction, structure, machinery installations and electrical installations of all types of ships, vessels and craft covered by IMO instruments, life-saving appliances, and survey and certification. In 2010 she was appointed Head of the Marine Technology Section, with overall responsibility for the IMO sub-committees dealing with ship design and equipment (DE), stability, load lines and fishing vessel safety (SLF) and fire protection (FP). She is also in charge of the implementation of the newly adopted goal-based ship construction standards for bulk carriers and oil tankers and the associated verification scheme.

Hon. Jan Arild Ellingsen is member of the Storting of Norway and Vice-Chairman of the Science and Technology Committee of the NATO Parliamentary Assembly. He has served as member of the Storting for Nordland County since 2001 and has been First Deputy Chair at the Standing Committee on Justice of the Storting from 2005 to 2009 as well as member of the Standing Committee on Foreign Affairs and Defence and a member of the Enlarged Foreign Affairs Committee. Mr. Ellingsen has long-standing career in the Progress Party and has served as first substitute member to the Central Executive Committee in 2008.

Hon. Rolf Einar Fife has been the Director General of the Legal Department of the Norwegian Ministry of Foreign Affairs since 2002. He served as Chair of the Council of Europe Committee of Legal Advisers on Public International Law (CAHDI) 2008–2010. He was also a Visiting Fellow of the Lauterpacht Centre for International Law at Cambridge University in 2009–2010. After graduating from the University of Oslo and working with the Ministry of Justice's Polar Department 1984–1985, he joined the Ministry of Foreign Affairs in 1985. He held postings in the Middle East 1988–1990 and at the Norwegian Mission to the United Nations in New York 1990–1993. He has in particular been working on issues pertaining to the law of the sea, international peace and security, international criminal law and management of natural resources. He has headed Norwegian negotiating teams, including on maritime delimitation with Denmark/Greenland, Denmark/The Faroes, Iceland and the Russian Federation, resulting in delimitation treaties. He headed the Norwegian team before the Commission on the Limits of the Continental Shelf, whose final recommendations as regards the submission for the North Atlantic and Arctic Ocean were issued in March 2009. He has been agent/advocate before the European Court of Human Rights and the World Trade Organization (WTO) Appellate Body. He was the representative of Norway before the International Court of Justice (ICJ) in the Kosovo proceedings in 2009 and was a member of the Norwegian team in the case concerning maritime delimitation between Greenland and Jan Mayen (ICJ, Judgment in 1993). He was the head of the Norwegian delegation in the negotiations on the International Criminal Court (ICC), including as chairman of the working group on penalties throughout the negotiation processes leading to the adoption of the Statute in 1998 and the Rules of Procedure and Evidence in 2002. He is since 2004 member of the Permanent Court of Arbitration in The Hague. He is Chairman of the Norwegian Branch of the International Law Association.

Dr. Maggy Heintz is scientific attaché in charge of physical sciences and innovation within the Science and Technology Department of the French Embassy in London, UK. She is interested in strategy and science policy covering research and development activities within the context of bilateral and international relationships. An Earth scientist by training, Maggy holds a Ph.D. in geophysics from the University of Montpellier II (France). Before joining the Science and Technology Department of the French Embassy, she conducted research in observational seismology at the Australian National University and at the University of Cambridge. Along with numerous field experiments, she studied the structure and deformation of the upper mantle beneath the continents.

Prof. Rob Huebert is an Associate Professor in the Department of Political Science at the University of Calgary. He is also the Associate Director of the Centre for Military and Strategic Studies. He was a senior research fellow of the Canadian International Council and a fellow with Canadian Defence and Foreign Affairs Institute. In November 2010, he was appointed as a Director to the Canadian Polar Commission. Dr. Huebert has taught at Memorial University, Dalhousie University and the University of Manitoba. His area of research interests include: international relations, strategic studies, the law of the sea, maritime affairs, Canadian foreign and defense policy, and circumpolar relations. He publishes on the issue of Canadian Arctic Security, Maritime Security and Canadian Defence. His work has appeared in *International Journal; Canadian Foreign Policy; Isuma-Canadian Journal of Policy Research* and *Canadian Military Journal*. He was co-editor of *Commercial Satellite Imagery and United Nations Peacekeeping* and *Breaking Ice: Canadian Integrated Ocean Management in the Canadian North*. He also comments on Canadian security and Arctic issues in both the Canadian and international media.

Dr. Marie Jacobsson is Principal Legal Adviser on International Law at the Swedish Ministry for Foreign Affairs (MFA) and member of the United Nations International Law Commission (UNILC), following her election in 2006 as only the third woman to serve on the UNILC. She is also Associate Professor of International Law at Lund University, Sweden. Following her appointment as an expert in international law at the MFA in 1987, she has led intergovernmental negotiations and has gained particular experience in international peace and security, the law of the sea and polar affairs, international humanitarian and human rights law, treaty law, space law, terrorism and disarmament. She has a long-standing interest in the polar regions, having worked with polar regions issues since 1986 both on a professional and an academic basis. Her experience of international law with the United Nations context also includes serving as a delegate to the United Nations General Assembly as well as working with international law issues during Sweden's membership of the United Nations Security Council in 1997–1998, and on international peace and security issues in connection with the Iraq–Kuwait war, the Kosovo conflict, 11 September and the war in Iraq in 2003. Prior to the MFA, she worked as a security policy analyst in the Swedish Armed Forces. She also has experience of international law in the European Union context, including during Sweden's two presidencies of the European Union in 2001 and 2009. She regularly publishes academic and popular scientific articles. Her most recent book is *International Law, the Sea and the Individual.*

Prof. David Johnson is Executive Secretary of the Commission to the 1992 *Convention for the Protection of the Marine Environment of the Northeast Atlantic* (OSPAR) and Bonn Agreement based in London and Emeritus Professor of Coastal Management at the United Kingdom Southampton Solent University. His career has included work in practical conservation, environmental consultancy, and higher education as well as intergovernmental marine environmental protection. His Ph.D. considered the conservation of inter-tidal wetlands and he has led international work on Particularly Sensitive Sea Areas. He is a Chartered Geographer and Chartered Scientist. In 2002, David held a Caird Fellowship at the UK National Maritime Museum. He is currently on the Steering Group of the Global Ocean Forum, a member of the Joint Group of Experts on the Scientific Aspects of Marine (GESAMP) pool of experts and a Visiting Professor at the World Maritime University in Malmo, Sweden. During his time with OSPAR, David has helped refocus the work of the Commission, through production of the *Quality Status Report* 2010, taking into account the European Commission *Marine Strategy Framework Directive*, climate change impacts and the challenge of Marine Protected Areas in Areas Beyond National Jurisdiction. He is an advocate for communicating OSPAR's achievements, forging partnerships and effective global networking. In 2010, in recognition for establishing the world's first network of High Seas Marine Protected Areas, OSPAR received a WWF "Gift to the Earth" Award.

Prof. Timo Koivurova is Research Professor, Director of the Northern Institute for Environmental and Minority Law (Arctic Centre/University of Lapland). He has specialized in various aspects of international law applicable in the Arctic and Antarctic region and has led many multidisciplinary international research projects. Professor Koivurova is a member of the International Union for the Conservation of Nature (IUCN) Commission on Environmental (CEL) and has been invited by the Norwegian Research Council to serve as a member in the steering committees' overseeing large research programs. He is also – together with Prof. Gudmundur Alfredsson – editor-in-chief of the *Yearbook of Polar Law*.

R. Andreas Kraemer has been Director of Ecologic Institute since its foundation in 1995. In April 2008, he became chairman of the Ecologic Institute in Washington DC – Ecologic's newly incorporated presence. With a strong background in institutional analysis and capacity building in sustainable development, environmental policy and resource management, he now focuses on integrating environmental concerns into other policies, notably European Union General Affairs and external relations, including trade, development, foreign affairs and security policy. He is particularly engaged in strengthening Transatlantic relations and cooperation on environment, climate and energy security.

Lars Kullerud has been the President of the University of the Arctic since 2002. Lars was one of the initiators of the United Nations Environmental Programme (UNEP) Shelf program, and worked earlier as polar program manager at UNEP GRID-Arendal. Lars has also been chief engineer at the resource analysis unit of the Norwegian Petroleum directorate. His academic background is in Precambrian geology and isotope geochemistry, development of geostatistical methods for petroleum resource assessments as well as assessments of the Arctic environment. Lars has authored or co-authored many publications in environmental sciences and geosciences, on both a regional and international level.

Prof. Joan Nymand Larsen studied economics at the University of Copenhagen, and received her Ph.D. in economics from the University of Manitoba specializing in economic development, northern economies. She is senior scientist with the Stefansson Arctic Institute in Iceland, and faculty with the Social and Economic Development and Polar Law programs, University of Akureyri. She was project manager and co-editor of the "Arctic Human Development Report" (AHDR) 2004 and leads "Arctic Social Indicators" (ASI) and AHDR-II (2010–2014) – focusing on quality of life and living conditions in the Arctic. She served as president of the International Arctic Social Sciences Association (IASSA) from 2008 to 2011. She currently serves on the Standing Science Committee of the Land Ocean Interactions in the Coastal Zone (LOICZ) program, which is a core project of the International Geosphere-Biosphere Programme (IGBP) and the International Human Dimensions Programme on Global Environmental Change (IHDP). She also serves as co-lead author the Polar Region section of the Intergovernmental Panel on Climate Change (IPCC) 5*th Assessment Report*.

Dr. James McQuaid is a mechanical engineer with a research career specializing in industrial safety. He retired as Director of Science and Technology and Chief Scientist of the United Kingdom Health and Safety Executive in 1999. He has since practiced as a consulting engineer in the assessment and management of risks to industrial safety and the environment particularly from catastrophic events and in the policy and regulatory aspects of their control. He is a former chairman of the Environmental Security Panel of the North Atlantic Treaty Organizations (NATO) Science for Peace and Security program and is currently an adviser on research projects commissioned under the program.

Capt. Vladimir V. Mikhailichenko is Executive Director at "Noncommercial Partnership of the Coordination of Northern Sea Route Usages," Russian Federation. He graduated from Leningrad Admiral Makarov Marine Academy in 1957 and worked in the Far-Easter Shipping Company (FESCO) as a third, second and chief mate. In 1964, Capt. Mikhailichenko started working for the Murmansk Shipping Company (MSCO), where he worked on ice-going vessels as chief mate and captain. During his 13 years as captain, he commanded MSCO's Arctic supply vessels, as well as a bulk carrier per contract (Czech Shipping Company). From 1982 to 1999, Capt. Mikhailichenko worked for the Northern Sea Route Administration (NSRA) as a Chief State Inspector, Deputy Head of the NSRA and as Head of the NSRA for 9 years. From 2001 to the present, Capt. Mikhailichenko has been working as an Executive Director at the "Noncommercial Partnership of the Coordination of Northern Sea Route Usages," having actively participated in its creation and registration. Formed in 2001, the Non-commercial Partnership of the Coordination of the Northern Sea Route Usages is a Moscow-based organization comprising federal and regional government officials, Russian shipping companies and international research and/or educational institutions.

Dr. Alexander V. Nikolaev is Doctor of Juridical Science, professor and scientific advisor to the Mineral Resources Section, Scientific and Expert Council, Maritime Collegium to the Russian Federation. He has worked at branch-wise scientific and research institutes and state bodies of the USSR and Russian Federation. Nikolayev is a leading advisor on scientific and research projects regarding energy policy issues.

Hon. Inuuteq Holm Olsen is Deputy Minister for the Department of Foreign Affairs of the Government of Greenland since July 2006. He served as Acting Deputy Minister for Foreign Affairs since December 2004 and as Head of Department from September 2003. Inuuteq began his career at the Department of Foreign Affairs in 1996 and was the Private Secretary to the Premier from 1997 through 1999. He was posted at the Danish Foreign Ministry in Copenhagen and was at the Greenland Representation in Brussels from 2000 to 2003. Inuuteq earned a B.A. in Political Science from the University of Alaska Fairbanks in 1994 and an M.A. in International Affairs from The George Washington University in 1996. Besides being the principal adviser to the Premier on foreign policy as well as security and defense and responsible for Greenland's foreign affairs, he has served as guest lecturer and speaker at numerous universities and international conferences on Arctic issues. He has been an expert adviser in the joint Danish-Greenlandic Commission on Self-Government regarding foreign affairs, 2006–2008. He was also a member of the 2008 Danish Defence Commission representing the Government of Greenland.

Jean-Nicolas Poussart is a geographer at the marine program in the United Nations Environmental Programme (UNEP) GRID-Arendal, where his main function is Geographic Information System (GIS) support to developing states with regard to data needs for their marine spatial management. His background includes an M.Sc. in Physical Geography and Ecosystem Analysis, and he has worked as GIS coordinator at UNEP's *Caribbean Environment Programme* in Cuba.

Dr. Peter Prokosch is the Managing Director of the United Nations Environmental Programme (UNEP) GRID-Arendal, which includes both the UNEP polar centre as well as the UNEP shelf program. Peters holds a Ph.D. in zoology on the function of the Schleswig-Holstein Wadden Sea as a spring staging area for Arctic shorebirds. Before Peter joined GRID-Arendal in 2006, he was the Chief Executive Officer of the World Wide Fund for Nature (WWF) Germany and prior to that – the Director of the *WWF International Arctic Programme*.

Prof. Olav Schram Stokke is a Research Professor at the Fridtjof Nansen Institute, Norway. He has held positions at the Centre for Advanced Study at the Norwegian Academy of Science and Letters, the International Institute of Applied Systems Analysis and the Political Science Department at the University of Oslo, and has served as director of numerous projects under international and national research financing institutions. His area of expertise is international relations with special emphasis on institutional analysis, resource and environmental management and regional cooperation. Dr. Stokke has published extensively in these fields, most recently *Managing Institutional Complexity: Regime Interplay and Global Environmental Change* (MIT Press 2011). His Ph.D. is in political science from the University of Oslo.

Harald Sund is the manager of continental shelf activities at Geocap A/S, a software company delivering the tool most often used by countries in their work with the Commission on the Limits of the Continental Shelf (CCLS) through the *United Nations Convention on the Law of the Sea* (UNCLOS). Harald has been a lead person on developing the associated software and he has taken part in most software training sessions for developing states organized by both the United Nations Division for Ocean Affairs and the Law of the Sea (DOALOS) and the United Nations Environmental Programme (UNEP) Shelf program. Harald is a civil engineer in petroleum prospecting.

Grigory I. Tsoy graduated from the Gubkin Russian State University of Oil and Gas, Faculty of Law (Department of Mining Law) and now works in the Ministry of Natural Resources and Ecology of the Russian Federation. Simultaneously, Tsoy is a Ph.D. student (part-time) at Department of International Law, MGIMO-University with the Ministry of Foreign Affairs of the Russian Federation. Mr. Tsoy has presented reports at various Russian and foreign scientific conferences and workshops, including on the issue of *Licencing of Subsoil – Key to Exploitation of Oil and Gas Fields.*

Dr. Dariya V. Vasilevskaya has been deputy director of the Department of State Policy and Regulation in the Area of Geology and Mining at the Ministry of Natural Resources and Ecology of the Russian Federation since 2006. Dr. Vasilevskaya graduated from the Gubkin Russian State University of Oil and Gas, Faculty of Law, in 2001 and successfully defended her thesis at the Russian Academy of State Service by the President of the Russian Federation for the Doctor of Juridical Science in 2009. She is the author of two books on legal issues related to subsoil use. Dr. Vasilevskaya also is Head of the Department of Mining Law at the Gubkin Russian State University of Oil and Gas.

Prof. Alexander N. Vylegzhanin is a Head of the Department of International Law, Moscow State Institute of International Relations (MGIMO-University). He is also a Director of Law Research Center of the Academic Institute, Council for Productive Resources (SOPS) within the Russian Academy of Sciences. He is currently elected as Vice-President of the Russian Association of the Law of the Sea. He is nominated by the Russian Federation to the list of arbitrators according to Annex VII of the UNCLOS. His major interest is general international law, international law of the sea, legal regime of natural resources, territory, boundaries, the Arctic and the Caspian Sea. Professor Vylegzhanin has publicized a wide array of books and manuscripts on international legal issues, including: *International Law* (2009, 2010, 2011); *Russia and Methods of Solving International Legal Problems* (2010); *International Legal Basics of Subsoil* (2007); *Spitsbergen: Legal Regime of Adjacent Marine Areas* (2007); *Russia and International Law* (2006); *Complex Management of Coastal Zones – Legal Glossary* (2005); *International Law* (2005); *International Court of Justice Decisions* *on Delimitation of Maritime Areas* (2004); *International Law of the Sea* (2003); and *Principal Legal Issues of Management of Natural Resources of the Caspian Sea* (2000). Professor Vylegzhanin was awarded a rank of Academician by the Russian Academy of Natural Sciences and a Medal by the Russian Academy of Natural Sciences (2001) for his book on *Legal Regime of Marine Natural Resources* (2001).

Prof. Peter Wadhams has been Head of the Ocean Optics Program and a Professor of Ocean Physics at the Department of Applied Mathematics and Theoretical Physics at the University of Cambridge since 2003. He was the Cecil and Ida Green Scholar at the Scripps Institution of Oceanography at the University of California, San Diego, as well as the Walker-Ames Professor at the University of Washington. He also served as Director of the Scott Polar Research Institute at the University of Cambridge from 1987 to 1992. He is internationally renowned for his research on the dynamics and thermodynamics of sea ice, sea ice thickness, waves in ice, icebergs, ocean convection and kindred topics. He has led 42 research expeditions to the polar seas and has worked extensively from Arctic submarines, most recently *HMS Tireless* (2007), using multibeam sonar to measure ice topography. He was a pioneer in the use of automated underwater vehicles under sea ice, with successful missions using *Maridan, Autosub II* and *Gavia* (2002–2008) vehicles. He was coordinator of the European Union Fifth Framework Priorities *GreenICE* and *CONVECTION* projects and currently is a principal investigator on the *Arctic Climate Change, Economy and Society* (ACCESS) project funded by the European Commission from 2011 to 2015. His numerous awards include the 1971 Bronze medal from the Government of Canada, for being one of six to complete "*Hudson-70"* circumnavigation and the 1977 W.S. Bruce Prize from Royal Society of Edinburgh "*for oceanographic investigations and for studies of pack ice behaviour near Spitsbergen, the North Pole and off East Greenland.*" In 1983, he was elected as a Fellow of the Arctic Institute of North America "*in recognition of significant contributions to the knowledge of the polar and sub-polar regions"* and in 1987 was awarded The Polar Medal, which was presented by H.M. The Queen. Among his books are: *Arctic and Environmental Change* (1997); *Ice in the Ocean (2000); The Great Ocean of Truth:* and *Memories of "Hudson-70", the First Circumnavigation of the Americas* (2009). His B.A. and Ph.D. are from the University of Cambridge.

Amb. Ingo Winkelmann works as Head of Division in the Legal Directorate-General of the German Federal Foreign Office. Previous diplomatic assignments include serving as German Ambassador to Angola and Deputy Head of Mission to Bosnia and Herzegovina as well as postings in New York (German Mission to the United Nations) and Syria. He was a Guest lecturer at Humboldt University Berlin (2004/2005, 2011) and has diverse publications on Africa, European and international public law including the law of the sea.

H.E. Hon. James R. Wright assumed his responsibilities as Canadian High Commissioner to the United Kingdom of Great Britain and Northern Ireland on August 27, 2006. Mr. Wright was born in Montreal, and attended McGill University (B.A., 1972; M.A., 1973) before joining the Department of Foreign Affairs in 1976. With the Canadian Foreign Service, he has served in Moscow (1978–1980), Washington (1983–1987) and London (1992–1996) where he was Minister, Political and Public Affairs, at the Canadian High Commission. In Ottawa, he has worked in the Office of the Prime Minister (1987–1988). From 1996 to 2000, Wright was Director General for the Central, East and South Europe Bureau. From 2000 to 2006, he was Political Director and Assistant Deputy Minister for the International Security Branch, representing Canada at G-8 Summits and other international fora. In his capacity as High Commissioner for Canada, Mr. Wright serves as an ex officio Governor of the Ditchley Foundation, and as a Member of the Board of the Commonwealth War Graves Commission and the Imperial War Museum. In 2008, Mr. Wright received an Honorary Doctorate from the University of Ulster, Northern Ireland. Mr. Wright speaks English, French and Russian.

Amb. Kenneth S. Yalowitz is Director of the John Sloan Dickey Center for International Understanding at Dartmouth College. Ambassador Yalowitz completed his undergraduate work at the University of Wisconsin and holds a Russian Institute Certificate, M.A. and Master of Philosophy degree from Columbia University. He retired from the United States Department of State in 2001 after 36 years as a career diplomat. He served twice as a United States ambassador: to the Republic of Belarus from 1994 to 1997; and to Georgia from 1998 to 2001. In 2009, Amb. Yalowitz was invited to join the American Academy of Diplomacy, whose active membership is limited to men and women who have held positions of high responsibility in crafting and implementing American foreign policy.

Prof. Oran R. Young is Professor of Environmental Policy and Governance at the Bren School of Environmental Science and Management at the University of California, Santa Barbara, Director of the Institute of Arctic Studies and an Adjunct Professor of Political Science at the University of Tromsø in Norway. Oran is a renowned Arctic expert and a world leader in the fields of international governance and environmental institutions. He served for 6 years as the founding chair of the Committee on the Human Dimensions of Global Change of the National Academy of Sciences in the United States and is now chair of the Scientific Steering Committee of the international project on the Institutional Dimensions of Global Environmental Change (IDGEC) under the auspices of the International Human Dimensions Programme on Global Environmental Change. In addition, Oran served for 6 years as Vice-President of the International Arctic Science Committee and is currently a leader in the development of a decentralized university of the Arctic. Professor Young's scientific work encompasses both basic research focusing on collective choice and social institutions and applied research dealing with issues pertaining to international environmental governance and to the Arctic as an international region. He has authored or co-authored more than 20 books, including: *International Cooperation: and Building Regimes for Natural Resources and the Environment* (1989); *Arctic Politics: Conflict and Cooperation in the Circumpolar North* (1992); *Arctic Accords and International Governance; International Governance: Protecting the Environment in a Stateless Society* (1998); and *Governance in World Affairs: Creating Regimes* (1999). His *most* recent book is *Institutional Dynamics: Emergent Patterns in International Environmental Governance* (2010).

Part I
Opening Remarks

Chapter 1
Opening Remarks

Arturo Nikolayevich Chilingarov

Distinguished Co-chairmen of the International conference "Environmental Security in the Arctic Ocean"! Dear participants and guests of the Conference!

The Arctic environment as a great object of international cooperation is both an ancient and a topical subject.

It is an ancient subject because it has been reflected in the reports about the first voyages of Russian coast-dwellers to "The Ice Cold Sea", in the sixteenth century decrees of the Russian Tsar Ivan Vasilievich about northern lands, in the early Canadian and Russian nature protection Arctic legislation.

It is also a modern subject because it is today, that economic ventures in the Arctic gain both in quantity and scale; a qualitatively new level of responsible international cooperation in this important area is called for.

The prime minister of Russia V.V. Putin in his speech on September 23 of this year [2010] at the international forum "The Arctic is a territory of dialogue" noted the importance of such cooperation in view of a "fragile Arctic ecosystem", the necessity to follow "the most strong ecological standards" in this region. Otherwise, as the prime minister of the Russian Federation noted, the Arctic states would receive here "global problems instead of global benefits."

For Russia, whose continental Arctic coast is the world's longest, the environment protection in the Arctic Ocean is also a strategic necessity. We must not allow in the Arctic an ecological catastrophe similar to the one, which has occurred this year in the Gulf of Mexico. Healthy ecosystems, stability of biological resources, preservation of unique flora and region fauna, prevention of accidents on the seaways

A.N. Chilingarov (✉)
Special Representative of the President of the Russian Federation
for International Cooperation in the Arctic and Antarctic,
1 Okhotny ryad Str., Moscow 103265, Russian Federation

P.A. Berkman and A.N. Vylegzhanin (eds.), *Environmental Security in the Arctic Ocean*,
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of the Northern Sea Route, in the areas of exploitation of deposits on the Russian shelf are essential tasks both for the regional authorities of the Russian North, and for federal authorities.

The above-mentioned international Arctic forum in Moscow has already underlined the necessity of international cooperation of both the Arctic and non-Arctic states in the environment protection in the ice mass and water column of the high-latitude Arctic, in the areas beyond the 200-mile exclusive economic zones of the five Arctic coastal states. Such cooperation is called for irrespective of the manner in which these Arctic states will delimit the Arctic continental shelf between them.

Cooperation, dialogue of interested states, scientists, representatives of responsible business community are also necessary for the protection of the air and sea environment in these high-latitude areas, taking into account a possible intensification here of air and sea transportation of cargoes and passengers in the future. Probably, it is necessary to think thereupon about the harmonization of the environment protection legislation of the Arctic states, applicable to the Arctic. Because all of us are interested in using here strong ecological requirements and corresponding most successful legal mechanisms.

I wish all successes to such a significant international conference!

Уважаемые Со-председатели международной конференции «Экологическая безопасность в Северном Ледовитом океане»! Уважаемые участники конференции и гости!

Окружающая среда Арктики как масштабный объект международного сотрудничества – это и древняя, и актуальная тема.

Древняя – потому что она была отражена еще в материалах о первых походах русских поморов в «Студеное море», в указах 16 века русского царя Ивана Васильевича о северных землях, в раннем канадском и российском природоохранном законодательстве …

Это и современная тема, потому что именно сегодня, когда экономические проекты в Арктике возрастают и в количестве, и в своих масштабах, востребован качественно новый уровень ответственного международного сотрудничества в этой важной области.

В выступлении 23 сентября этого года премьер-министр России В.В. Путина на международном форуме «Арктика – территория диалога» отмечена важность такого сотрудничества ввиду «хрупкой экосистемы» Арктики, необходимости учета в этом регионе «самых строгих экологических требований». В ином случае, как отметил премьер-министр Российской Федерации, арктические государства получают здесь «не глобальные преимущества, а глобальные проблемы».

Для России, материковое арктическое побережье которой занимает первое место в мире по протяженности, охрана окружающей среды в Северном Ледовитом океане – это стратегическая необходимость. Мы не вправе допустить в Арктике экологическую катастрофу, подобную той, которая произошла в этом году Мексиканском заливе. Здоровые экосистемы, устойчивость биологических ресурсов, сохранение во многом уникальной флоры и фауны региона, предотвращение аварий на трассах Северного морского пути, в районах разработки месторождений российского шельфа – это насущные задачи и для региональных властей Российского Севера, и для федеральной власти.

На упоминавшемся международном арктическом форуме в Москве уже была отмечена необходимость международного сотрудничества и арктических, и неарктических государств в деле охраны окружающей среды в ледовой и водной толще высокоширотной Арктики, в районах, находящихся за пределами 200 мильных исключительных экономических зон пяти государств, прибрежных к Северному Ледовитому океану. Такое сотрудничество востребовано независимо от того, как эти арктические государства осуществят разграничение между ними континентального шельфа.

Сотрудничество, диалог заинтересованных государств, ученых, представителей ответственного бизнес-сообщества необходимы и в деле охраны воздушной и морской среды в этих высокоширотных районах, с учетом возможной интенсификации здесь воздушных и морских перевозок грузов и пассажиров в будущем. Возможно, стоит в этой связи подумать и о гармонизации законодательства об охране окружающей среды арктических государств, применимого к Арктике. Потому что мы все заинтересованы в использовании здесь строгих экологических требований и соответствующих наиболее удачных правовых механизмов.

Желаю успехов столь значимой международной конференции!

Специальный представитель
Президента Российской Федерации
по международному сотрудничеству
в Арктике и Антарктике

А. Н. Чилингаров

Chapter 2
Opening Remarks

Inuuteq Holm Olsen

Changes are inevitable – but the pace and nature differ over time, where the changes taking place these years have gone much faster due to a number of factors. Change can come from within as a desire or wish to improve current conditions, or it can be externally induced from a desire from external actors to have a say about matters. It can also be from actions which we do not have control over, for example markets abroad eyeing new opportunities in the Arctic, or it can be because people have the best intentions for the Arctic. Often, if not always, there is an intricate relationship between inside and external forces of change. Several regime changes are taking place including, with the Arctic Council and how the Arctic Ocean countries are taking up the challenges. Instead of talking about traditional potential conflicts, it is more a conflict between different mindsets of how the Arctic should be dealt with in the future. In this process of change, the critical aspect will be how change is handled by those affected, or "inside" the Arctic.

Societies and cultures have always experienced changes – one could say that it is predestined because we ourselves go through several changes; our seasons continually go through a cycle from summer to fall, to winter to spring. The new situation is that winter possibly comes a month later than usual and we have to adapt to that change. Island mentality is such that people are coming from the outside bringing with them new ideas, thoughts and ways of doing things that also brings about change. Change therefore comes from within as a result for a desire or wish to improve things or it can be externally induced from a desire to have a say about matters, it can be from actions we have no control over, for example markets abroad eyeing new opportunities or it can be because people have the best intentions for the Arctic. Often if not always, there is an intricate relationship between inside and external forces of change. Several regime changes are taking place including with the Arctic Council and how the Arctic Ocean countries are taking up the challenges.

I.H. Olsen (✉)
Department of Foreign Affairs, Namminersorlutik Oqartussat,
Imanewq 4, Postboks 1015, 3900 NUUK Oqartussat, Greenland
e-mail: inol@gh.gl

P.A. Berkman and A.N. Vylegzhanin (eds.), *Environmental Security in the Arctic Ocean*,
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Instead of talking about traditional potential conflicts, it is more a conflict between different mindsets of how the Arctic should be dealt with in the future. In this process of change, the critical aspect will be how change is handled by those affected, the people.

The Arctic Ocean being a part of the Arctic in general has for many years been this abstract notion far away from the population centres. It is not until recent years that factors, such as climate change and its multiplying effects has brought about increased attention to this area. Possibilities for new shipping routes, the energy demands of an ever growing global population as well as wishes and demands from those living in the Arctic are drivers of these changes.

The Arctic Council was established in 1996 and many will rightfully argue that the foundation for the council is rather weak. Many reasons can be explored but one of the reasons is probably because it was difficult to see a need to have a strong regime when there is no need for one. The increased focus on the Arctic, and because the council is the only forum where you have all the arctic countries present as well as the indigenous peoples representatives, and the proliferation of observers wanting to partake in the discussions and cooperation, we are now witnessing a call for a strengthened council that comes from within. The Tromsø Ministerial Declaration from 2009 gave the mandate to consider how to best structure the council in fulfilling its objectives and decided to continue discussing the role of observers. The combination of a weak regime and many new players is a recipe for the council to lose its ability to set the agenda. Whether it is real or perceived is not as important as the perception itself.

We have also seen the Arctic nations bordering up to the Arctic Ocean, popularly called the Arctic 5 creating an alliance of a statement in the form of the Ilulissat Declaration from 2008 with regard to the ongoing debate on how to best approach issues pertaining to the Arctic Ocean. The Ilulissat Declaration was in many ways a response or reaction from the 5 countries to the pressure from coming from outside the Arctic, as one can argue is also the case with the discussions on how to strengthen the Arctic Council.

Even with the increased popularity of discussing the environmental and physical changes, the human dimension in the Arctic is also going through some major developments these years. Greenland took a major step last year with a new relationship with Denmark of continuing taking over responsibilities in our long term process of building up our own nation-state. For the first time, language in the new law is in place describing the process of secession as well as being recognized as peoples under international law. It is not about fixing a date for this as it is a long term process of capacity building in all areas. In this process, reaching financial independence from Denmark is a key issue and development of our natural resources critical in reaching that goal. That is why we are very focused on developing and benefiting from our natural resources, especially the oil and gas sector. For us it is simple. If we don't develop the very few economic advantages we possess, we will not reach our political goals.

A lot of critical voices have been raised as exploratory drillings were conducted offshore the Disco Bay area this summer at the same time as the oil spill accident in the Gulf of Mexico. What can best be described as panic reactions followed: Germany presented a proposal to the OSPAR convention, a not very well thought out proposal to ban deep sea drilling which would include Northeast Greenland. We saw illegal action undertaken by Greenpeace, some might well argue that the organization have noble causes, but in the Arctic has no credibility at all because of its campaings against seal hunting which left our hunters and the sealskin market paralyzed for many years. The Canadian government were also concerned and voiced their criticism. After having been explained thoroughly about our regulatory framework and emergency procedures, we were able to convince the Canadian Minister for Enviroment that we have the world's highest standards when it comes to environmental protection and emergency preparedness in offshore drillings. The result was that Canada is learning from our experiences and from our regulatory framework.

We welcome focus and attention on environmental issues. We welcome focus on using the highest standards and best technologies when it comes to offshore drillings. We should always aim for the highest standards when it comes to environmental protection. What we don't welcome is the notion that there shouldn't be any industrial development in the name of environmental protection. What the rest of you have been benefiting from should not be denied to us in the Arctic. There is always a risk when you undertake a course of action and no guarantees can be issued. But you should be prepared and prevent as much as possible with emergency plans and employ highest environmental standards. That's why we have called for a set of common standards, highest standards to be employed all over the Arctic when it comes to development of natural resources. We believe we have the world's toughest standards.

The last few years we have witnessed an increased attention on the Arctic from the outside world. This can also be interpreted as a wish to have a say about the course of direction. There is general agreement among the Arctic countries to face the challenges in a cooperative manner and solve any disputes through peaceful negotiations. The Ilulissat Declaration and the recent developments on the future of the Arctic Council are some of the illustrations of an Arctic that doesn't face immediate threats when it comes to conflict – conflict as we traditionally know it as competition between states especially over resources. Where we have seen conflict – some may not call it conflict – arising is on what course of direction the Arctic should take. Questions have in the past arisen if the Antarctic treaty system also be applicable to the Arctic. Should it be protected at all cost against any resources development? Do countries outside the Arctic have a say or should they have a say? Where do you draw the line? When should prohibition of resource development take precedence in the name of environmental protection? What about the economic needs and political aspirations for us that live there? Is the Arctic an "á la carte" menu for everyone interested?

There is a Danish movie playing right now called the "Experiment" based on a real story of 22 Greenlandic children taken away from their families and shipped to Denmark and then bring them up in an orphanage in Nuuk with little contact as possible with their Greenlandic families. The goal was to create group of elites of well educated children who were to become the role models for all Greenlanders. In the process they stripped them of their Greenlandic language and identity with the result that they were not able to communicate with their parents and families. The morale, as seen by the Danes even today is that, they had the best intentions. That you destroy a few souls doesn't really matter as your actions had the best intentions.

Who knows what is best for us? Because non-Arctic states have noble causes, does that correspond to what the Arctic should be or move towards to? If there is a lesson we have learned in Greenland from the colonial past, is that we cannot have development of any kind without the involvement of the people. That is why we are taking the course of action of transferring power to Greenland in the coming years and why income from natural resource development is so important if we are to achieve our political goals. We realize that not all parts of the Arctic have the same system as we do and we have to take that into account. But we still have to have the basic element called respect into play.

We might have opposing ideas or conflicts as how to manage issues pertaining to the Arctic. There should still be room to discuss these, as this forum is an example of, and try to reach an understanding. We shouldn't have to resort to isolation in order to protect our interest. There is basis and need to increase the already existing cooperation between many countries in the Arctic. The underlying principle of any actions taken should be respect. If there is no respect, then there is no basis for any relationship.

I look forward to the next couple of days discussions and would like to express my hopes for a constructive dialogue and exchange of opinions.

Qujanaq – thank you.

Chapter 3
Opening Remarks

Jan Arild Ellingsen

Ladies and gentlemen, esteemed participants of this important and timely workshop,

On behalf of the NATO Parliamentary Assembly, allow me to most sincerely congratulate the organizers of this workshop, particularly Dr. Paul Berkman, and to express our gratitude for involving NATO parliamentarians in the debate on the High North. I believe that it is an excellent format to bring together scientists, experts, government officials and legislators, and I hope that we will have more opportunities in the future to participate in the events organised within the framework of the NATO Science for Peace and Security programme.

The NATO Parliamentary Assembly is one of the principal vehicles to raise the awareness of the challenges in the Arctic among legislators in the Euro-Atlantic area. In recent years, this subject features constantly on the agenda of our Assembly, and currently one of our Sub-Committees is preparing a report called "Security at the Top of the World: Is there a NATO role in the High North?"

There is a theory that conflicts are mostly driven by *greed* rather than *grievance*, in other words, the desire to control *abundant* resources is more likely to trigger conflicts than the *scarcity* of resources. If this theory is true, the Arctic with its alleged 25 % of global oil and gas resources may be the last big territorial dispute in the world. In addition, there is a considerable economic value in the opening of new shipping routes connecting Northeast Asia and Northern Europe that would be much quicker than via the Panama or Suez canals.

We have seen some actions that have led commentators to warn of a new Great Game in the North: the development and fielding of new military assets and facilities in the region, the issuing of strategic documents calling for the defence of national

J.A. Ellingsen (✉)
Standing Committee on Foreign Affairs and Defence, Stortinget, 0026 Oslo, Norway / NATO Parliamentary Assembly, Science and Technology Committee, 3 Place du Petit Sablon, 1000 Brussels, Belgium
e-mail: utenriks-forsvar@stortinget.no

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interests in the region, and symbolic actions such as flag-planting on the ocean floor. Some commentators have also expressed worries about the increasing interest expressed by actors from beyond the region such as China and the European Union.

These developments are often exaggerated in the eyes of the public opinion, creating an impression that the Arctic nations are on the verge of a serious conflict.

That is far from the truth. I have no doubt that the Arctic nations will settle existing disagreements within the frameworks that already exist, particularly within the Arctic Council. The United Nations Convention on the Law of the Sea (UNCLOS) provides an adequate framework for addressing territorial disputes, and I am convinced that if the United States ratified this Convention, it would greatly enhance the reputation of the Arctic as a stable and predictable region. The United States has signed the renowned Ilulissat Declaration which contains reference to UNCLOS. Ratifying the convention itself would bring the process to a logical conclusion.

Ensuring stability in the Arctic must be a process based on international law and existing cooperation mechanisms, focusing on civilian economic and scientific collaboration and environmental stewardship as well as protection of the rights and traditions of indigenous peoples. Being a Norwegian, I believe that the recent agreement between Russia and Norway on delimitation of the Barents Sea represents an excellent example of how the issues of the High North can and should be solved.

That said, the increase of military presence in the High North is inescapable. NATO, its Arctic Allies and Russia must establish cooperation patterns in order to ensure security of shipping routes, to protect emerging energy infrastructure and to bolster search and rescue, emergency response and consequence management capabilities. NATO could be involved in areas such as information and intelligence fusion as well as training and equipping forces capable of operating in the Arctic environment.

It also is imperative for the Alliance to be aware and to discuss wider security implications of diminishing ice. Take for instance the fact that the Arctic Ocean will become easily available for navigation. By the way, this possibility was raised before the US Congress for the first time back in the 1950s, when an American oceanographer Roger Ravelle testified that the navigable Artic Ocean would make the Soviet Union a great *maritime* nation. That would be a considerable change. Experts in geopolitics agree that *continental* powers, such as Russia, act quite differently than maritime ones, such as Britain or the US. Continental powers have certain fears, phobias and insecurities that could translate into the need for 'buffer zones' and relentless territorial expansion. How would Russia's foreign policy change should it become a maritime power? It remains to be seen, but it would certainly have an impact on the global security landscape. Although Russia is not an antagonist anymore, it remains an important international actor, and changes in its behaviour must feature in our strategic deliberations.

In conclusion, I remain optimistic that the High North will remain an area of low tension, where emerging opportunities can be properly supported by a stable, inclusive regional dynamic. I believe that NATO, as a supporting part of a web of institutional and legal arrangements in the region, can play a role in ensuring continued co-operation in the Arctic, although the extent of that role remains to be determined.

Thank you very much, and, again, I and my colleagues, NATO Parliamentarians, are very much looking forward to participating in this very interesting workshop.

Part II
Environmental State-Change in the Arctic Ocean

Chapter 4
Diminishing Sea-Ice Extent and Thickness in the Arctic Ocean

Peter Wadhams

Abstract Rapid changes are occurring to Arctic sea ice thickness and extent. We survey the reasons for them, and the methods being used to monitor the changing thickness. Through the late twentieth century Arctic sea ice extent shrank at a relatively modest rate of 3–4% per decade (annually averaged) but after 1996 this speeded up to 10% per decade and in summer 2007 there was a massive collapse of ice extent to a new record minimum of only 4.1 million sq km. Thickness has been falling at a more rapid rate (43% in the 25 years from the early 1970s to late 1990s) with a specially rapid loss of mass from pressure ridges. The summer 2007 event may have arisen from an interaction between the long-term retreat and more rapid thinning rates. We review thickness monitoring techniques which show the greatest promise on different spatial and temporal scales, and for different purposes, and we show results from some recent work from submarines.

4.1 Sea-Ice Thinning and Retreat

The present thinning and retreat of Arctic sea ice is one of the most serious geophysical consequences of global warming and is causing a major change to the face of our planet. A challenging characteristic of the behaviour is that both the rate of retreat (especially in summer) and the rate of thinning in all seasons have greatly exceeded the predictions of most models. A further challenge comes from the fact that Antarctic sea ice extent is currently expanding, at about half the rate that Arctic extent is diminishing [8].

P. Wadhams (✉)
Department of Applied Mathematics and Theoretical Physics,
University of Cambridge, Wilberforce Road, Cambridge CB3 0WB, UK
e-mail: p.wadhams@damtp.cam.ac.uk

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Although sea ice in the Arctic Ocean has been in slow retreat since the 1950s at a rate of 2.8–4.3% per decade [1] as measured since 1979 from passive microwave satellites [23], the annual-averaged rate speeded up to 10.7% per decade from 1996 onwards [8], while the summer extent has shrunk even faster. In September 2007 the area reached 4.1 million km^2, a record low [22, 33] and more than one million km^2 less than in the previous record year of 2005 [32]. Although the area stabilised in 2008–2011 the continuing decline in multi-year ice fraction suggests that the total Arctic ice volume in late summer has continued to decrease. New model predictions, tuned to match these recent changes, predict disappearance of the summer sea ice within 20–30 years [52].

At the same time, submarine sonar measurements have shown that the ice has been thinning much more rapidly, by some 43% in the 25 years between the early 1970s and late 1990s [27, 28, 42, 43, 53]. The thinning rate implies that at some critical date the annual cycle of thickness will have a summer minimum which is small enough that a substantial fraction of the winter ice cover will have disappeared, with the thinner component (mainly undeformed first-year ice) melting completely. We may be already reaching this situation, since in the Beaufort Sea the measured summer bottom melt in 2007 was 2 m [24] while the winter thickness achieved by first-year ice was only 1.6 m.

Figure 4.1 shows the ice cover on September 16, 2007, with a huge area of open water extending northward from the Beaufort and Chukchi Seas, exposing the ocean there to the atmosphere for the first time since records began. The figure also shows the March 2007 track of HMS *Tireless,* which carried out a multibeam sonar survey of the ice underside, described later in this paper.

Already we are seeing consequences from these changes. The new large area of open water warms up to 4–6 °C during summer, which not only delays the onset of autumn freezing but also warms the seabed over the shelf areas, helping to melt offshore permafrost. One consequence of this melt is the release and decomposition of trapped methane hydrates, causing methane plumes which have global warming potential. Already such plumes have been directly observed in the East Siberian Sea [31] and off Svalbard, and the curve of global atmospheric methane content has undergone a (small) upward blip after being stable for some years. Molecule for molecule, methane is 23 times more potent than CO_2 as a greenhouse gas, although its residence time in the atmosphere is less.

A further consequence is that the large area of open water in summer allows a wind fetch sufficient to create substantial wave energy input to the ice edge, which causes wave-induced ice break-up into floes so as to create a classic marginal ice zone (MIZ). Hitherto the MIZ structure has been considered as applying mainly to the Greenland Sea, Barents Sea, Bering Sea and Antarctic, with the Beaufort-Chukchi region facing only a narrow slot of open water. A Beaufort-Chukchi MIZ is a new situation which may also feature a positive feedback mechanism, because the fragmentation of the ice cover into wave-driven floes creates much new open water and a large floe perimeter for enhanced melt rates.

A challenging characteristic of the summer sea ice extent is that its decay has exceeded the predictions of models. The observed extent began to deviate from the

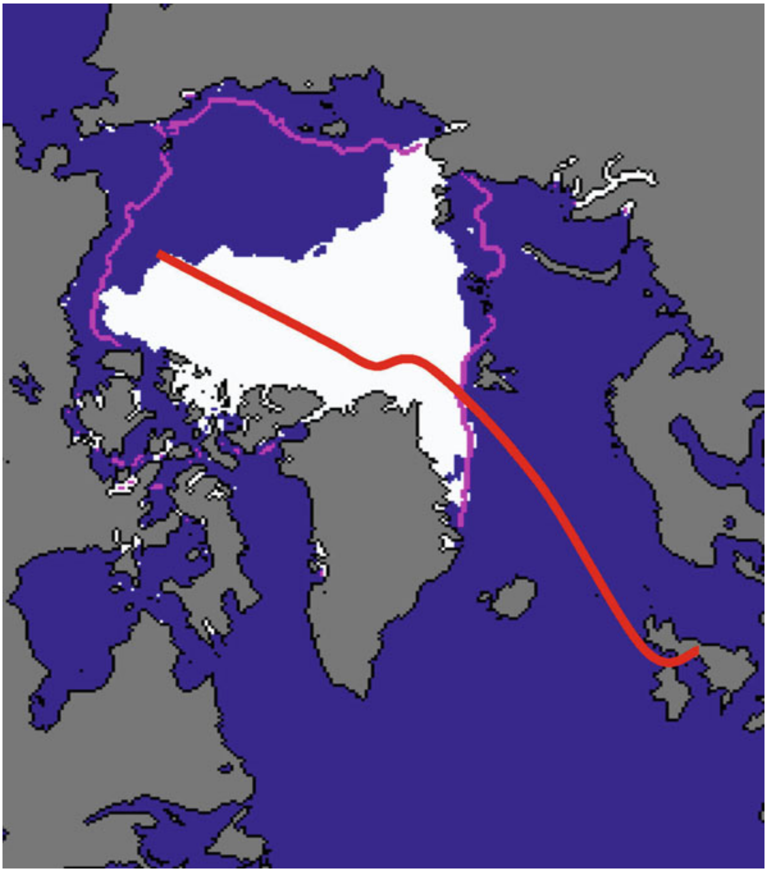

Fig. 4.1 Sea ice extent at the 16 September 2007 absolute minimum, with the 2007 track of HMS *'Tireless'* shown across the Arctic Ocean

ensemble mean of models used by the Intergovernmental Panel on Climate Change in the 1970s and by the 1990s it was more than one standard deviation less than the mean (Fig. 4.2). The 2007 extent was less than the most extreme member of the ensemble. These results strongly suggest that existing climate models are inadequate in predicting Arctic sea ice extent and that some important physics is missing.

Our understanding of the processes governing these accelerating changes needs to be based on adequate measurements of ice thickness and extent throughout the year, particularly in the winter months preceding each summer's retreat. Ice area can be tracked by satellites, but ice *thickness* distribution can only be accurately measured by sonar from underneath the ice. This task has been carried out since 1958 by submarines of the US and British navies, with the most recent UK datasets being in 2004 and 2007. Since the first UK voyage in 1971, scientific data gathering and analysis from UK submarines has been done by the author, who has sailed on

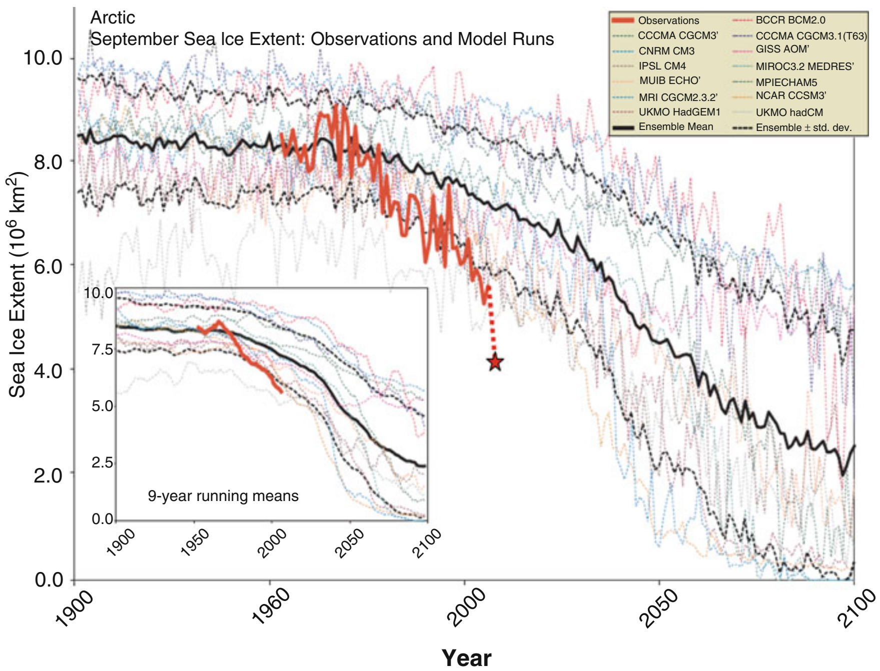

Fig. 4.2 The September sea ice extent (*red*) compared with the predictions and hindcasts of an ensemble of models used by the Intergovernmental Panel on Climate Change. *Thick black line* is median of model predictions; *dotted black lines* are one standard deviation away (Modified from [33])

many of the voyages himself. The first evidence of Arctic ice thinning, amounting to 15% up to 1987, was published by the author in 1990 [37], while incorporation of more recent UK and US data has shown an enormous 43% decline in thickness from the 1970s to the late 1990s.

4.2 Mechanisms for Sea Ice Retreat

It is clear that a link exists between retreat and thinning, in that a thinner ice cover breaks up and opens up leads more readily in summer, leading to greater radiation absorption by the ocean, further enhancing the melt rate. In theory, thinning can come about by surface melt, due to warmer air temperatures [6]; from an increase in the length of the melt season [18]; or from a change in the composition of the ice cover with less multi-year ice [5, 15], as well as from bottom melt, which itself could be caused by advection of warm water into the Arctic rather than local warming [19, 28]. However, the dependence on long-term thinning is supported by the summer 2007 field observations of Perovich et al. [24] that ice in the Beaufort Sea showed no less than 2 m of bottom melt in places during the summer of 2007 – far more than the expected thermodynamic summer melt of 0.5 m. A 2 m summer melt would cause

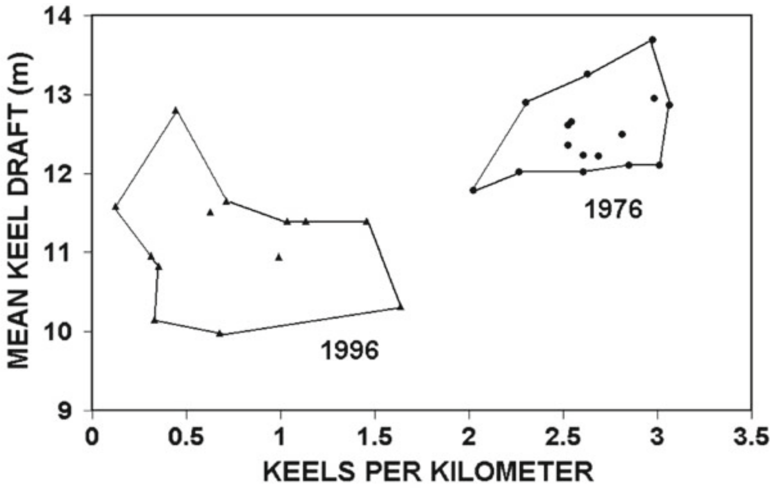

Fig. 4.3 Frequency and mean draft of keels deeper than 9 m in 1976 and 1996 in Eurasian Basin (Redrawn from [42])

the disappearance of all the undeformed first-year ice in the Beaufort Sea, which in late winter 2007 had a mean thickness of only 1.6 m. Perovich et al. [24] explained that the ice became exceptionally open as summer approached, with a large network of leads absorbing solar radiation to heat up the near-surface water. This water, penetrating under the surrounding floes, caused bottom melt. The results of Rothrock et al. [27] show that in many sectors of the Arctic the mean is itself only in the vicinity of 2 m, implying that a 2 m summer melt will remove much of the ice cover.

A clue to the missing physics that may be needed to explain thinning and retreat was the discovery from successive submarine cruises to the same part of the Arctic that the decline in thickness was most pronounced for pressure ridges. While the mean draft showed a 43% drop between two cruises in 1976 and 1996, the occurrence of pressure ridges deeper than 9 m showed a much more dramatic drop of 73% (together with a decrease in their mean draft), implying a virtual absence of deep pressure ridges from the central Arctic (Fig. 4.3, [42, 43]). The pressure ridge reduction suggests a change in ice dynamics as well as an enhanced melt rate for existing ridges. The loss has been demonstrated in a practical way by the fact that icebreakers now routinely transport tourists to the North Pole, which in the past was a dangerous and difficult procedure: the North Pole was not attained by surface ship (a Soviet icebreaker) until 1977.

The suggestion therefore is that, rather than uniform thinning taking place, there is a preferred loss of pressure ridge volume; they may be melting more rapidly than undeformed ice. Support for this idea comes from a set of submarine observations reported by Wadhams [38, 39] in which the development of a thickness probability density function (*pdf*) with downstream distance in the Trans Polar Drift Stream implied a melt rate that was proportional to ice thickness. Such a melt rate cannot be explained by thermodynamic considerations alone [29], even though thermodynamic

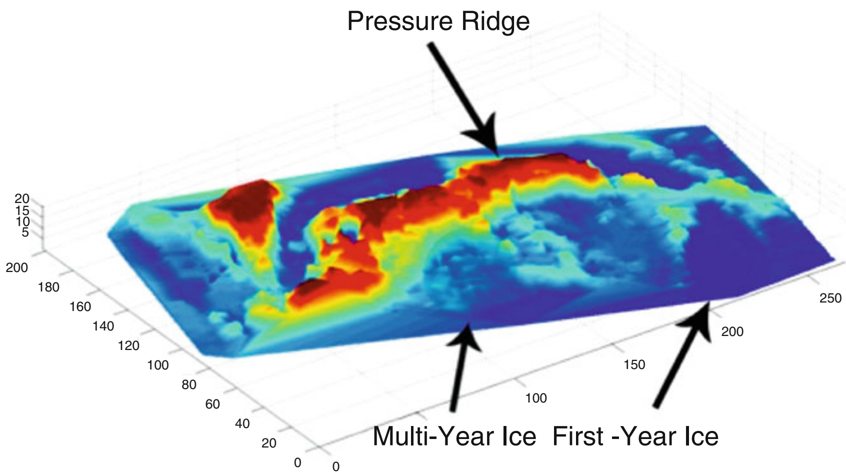

Fig. 4.4 Structure of a multi-year pressure ridge, seen on multibeam sonar of HMS "Tireless"

theory implies that there is an equilibrium thickness of sea ice (about 2.9 m) and that ice which is taken beyond this limit, i.e. by ridging, should slowly melt while ice that is thinner continues to grow. The first potentially feasible mechanism was put forward by Amundrud et al. [2] which supposes that a ridge structure is porous and that the percolation of warmed sub-ice water, especially in summer, raises its internal temperature and causes it to preferentially melt or disintegrate. This implies that MY ridges, where the blocks are cemented together into a solid hummock, should be more resistant to percolation than FY ridges.

To test such theories, we must understand in detail how pressure ridges develop and how they interact with the ocean. The most recent submarine dataset collected in a transArctic experiment by HMS "Tireless" in March 2007 [40, 51] allows such a study because the normal upward-looking echo sounder (ULES) was supplemented by a multibeam sonar which gives a full 3-D quantitative picture of the underside of the ice along a swath approximately 100 m wide (Fig. 4.4). This shows the true structure of ridges for which the ULES gives only a cross-section.

It is therefore likely that bottom melt is a main factor in ice thinning. To understand the mechanism of ice retreat, a two-pronged experimental approach is therefore necessary: we must obtain large-scale data on $g(h)$, the probability density function of thickness, to map the continuing rate of loss and its geographical variation; and we must map in detail the way in which the topography of a deformed ice area evolves as a result of melt. For both these aims, the acquisition of under-ice sonar data is vital, especially 3-D multibeam data from Autonomous Underwater Vehicles (AUVs) and submarines under ice.

Interpretation of these data will yield the detailed physics of the ice melt process, which must then be incorporated into models to predict more adequately the future decay rate of the sea ice cover in the Arctic Basin and adjacent seas. Ice retreat has huge implications for global climate change: it is a source of ocean freshening from meltwater fluxes; the ice-albedo feedback mechanism involved may accelerate global warming; and it also participates in further feedbacks, e.g. by enhancing the melt rate of the terrestrial ice sheet on Greenland which will be surrounded by open water for more of the year, or by diminishing the convection rate in the Greenland Sea. Sea ice melt adds freshness to the ocean without raising sea levels, and this affects models which relate freshening to sea level rise by assuming glacier melt to be the cause [21, 46]. At some stage ice retreat will start in the Antarctic, and we need to know when and how fast this will happen in view of the different ridge composition and distribution there.

4.3 Methods of Ice Thickness Measurement

The fundamental parameter which we seek to measure is the ice thickness distribution and its variability over the Arctic Basin both in space and time. This is a real challenge to technology since no fully adequate and accessible method exists at present to achieve this aim. It is important to measure not just the mean thickness but the entire probability density function *g(h)* because:

(i) *g(h)* determines the ocean–atmosphere heat exchange, with thin ice dominating;
(ii) together with the ice velocity, it gives mass flux;
(iii) its downstream evolution, in the absence of deformation, gives the melt rate, i.e. the fresh water flux;
(iv) the shape of *g(h)* is a measure of the degree of deformation of the ice cover;
(v) if multi-year fraction is also known, *g(h)* can be used to give ice strength and other statistically definable mechanical properties of the ice cover;
(vi) its variability is a test of model outputs;
(vii) its long term trend indicates the nature of the climate response.

In addition to *g(h)* it is also valuable to have a measure of the ice bottom shape or roughness. This implies recording ice bottom surface profiles rather than simply sampling the draft at fixed time intervals as is done with moored sonar. The extra advantages of knowing ice surface shape are:

(i) it is a determining factor for the aerodynamic and hydrodynamic drag coefficients;
(ii) the deepest ridges are responsible for generating internal wave activity which may lead to a significant internal wave drag;
(iii) seabed scour by the deepest ridges defines the limit of fast ice on shelves and the extent of the stamukhi zone [25];
(iv) ridges are an important component in the calculation of the force exerted by an icefield on offshore structures;
(v) the scattering of underwater sound by ridges defines the range to which acoustic transmission can be accomplished in the Arctic, since upward refraction leads to repeated surface reflection;
(vi) ridged ice provides a different habitat for sea ice biota from undeformed ice.

Methods of measuring ice thickness distribution in the Arctic can be divided into existing well-tried techniques and new methods.

4.4 Ice Thickness – Current Techniques

Submarine sonar gives us the ability to obtain synoptic data on ice draft and under-ice topography in a rapid and accurate fashion, and most of our knowledge of the general distribution of *g(h)* over the Arctic comes from such profiles. ***Sidescan sonar*** [30, 36] or ***multibeam sonar*** [40] can be added to give extra information about ice type and bottom topography. However, military submarines are not always available to obtain repeated profiles at a sufficient density to test for climate-related trends, nor are they necessarily able to profile over a desired systematic grid since ice profiling is an addendum to their operational task. Conversion of draft to ice thickness is a simple and accurate procedure, and in applications related to mass flux it is in fact useful to deal with draft as the relevant parameter, since this defines ice mass per unit surface area.

AUV sonar solves the problem of military data availability by placing the profiling sonar on an unmanned vehicle; this also enables the vehicle to work in shallow water and other unsafe situations. For short-range surveys the vehicle could be a cable-controlled ROV (Remotely Operated Vehicle), but for mesoscale and basinwide surveys it would have to be an AUV (Autonomous Underwater Vehicle). The earliest AUV operation under ice was carried out by Francois [9] using an AUV in the Beaufort Sea; other early work is reviewed by Tonge [35], while recent deployments are described by Brierley et al. [4], Wadhams et al. [48–50] and Wadhams and Doble [44]. The latter experiments featured sidescan and multibeam sonar, of which the latter offers full 3-dimensional quantitative mapping capability of the ice underside, the best quality data yet obtained under Arctic sea ice.

Drifting sonar involves placing a local sonar system on a drifting buoy, and intensively studying the time-dependent development of ice and snow thickness of a single floe. By using an upward sonar under the ice and a downward pinging sonar in air over the ice surface (together with thermistor chains) it is possible to separate the development of the upper and lower surfaces. Data are transmitted back by satellite.

Moored upward sonar solves the problem of systematic data collection by obtaining long-term information from a single point. It is invaluable for assessing the time variation of ice flux through critical regions such as Fram Strait. However, the ping rate is usually inadequate to resolve bottom topography, while the cost and difficulty of deployment and recovery preclude its general use over the whole Arctic on some systematic measurement grid.

Airborne laser profilometry yields freeboard distribution that can be converted to draft distribution if the mean density of ice plus overlying snow is known [47]. This varies with time and space over the Arctic, implying that seasonal and regional validation is needed before this otherwise rapid and efficient technique can be used for basinwide surveys. Recent developments include swath sounding lasers, which give a three dimensional image of the freeboard, making validation easier by facilitating matching with other types of profile.

Airborne electromagnetic techniques consist of generating and sensing eddy currents under ice by VLF (10–50 kHZ) EM induction from a coil towed behind a helicopter, with simultaneous laser to give range to the snow surface. The early development of the technique was reviewed by Rossiter and Holladay [26]. The wide footprint involves some loss of resolution of individual ridges and a need to fly very low. The first packaged system fixed wing aircraft use in the Arctic appears to be the system mounted in a Twin Otter by the Finnish Geological Survey [13], and recently the Alfred Wegener Institute Dornier has been fitted with antennas. Its use towed from a helicopter does, however, permit improved resolution [12].

Drilling is the most accurate, but slowest, technique, the ultimate validation for all others. The use of a hot water drill increases the speed over that of a drill with a petrol-driven power head, and the replacement of the drill bit by a core barrel enables the ice to be directly sampled for salinity and other physical properties.

Radar altimetry involves the use of a radar beam from an aircraft or satellite; the time difference between the radar echo from the ice surface and from nearby thin ice or open water lying within the beam gives the freeboard. From this a conversion must be made to thickness from a knowledge of the mean density of sea ice and the thickness and density of the overlying snow. Results from the Envisat altimeter have been used to estimate the variability of mean ice thickness over the Arctic up to 81.5°N [10, 18], while the European Space Agency CryoSat-2 altimeter, launched in 2009, reaches the Pole. The problem, as in laser profiling, is to use the correct conversion factor for the large multiplier needed to turn freeboard into thickness. An additional problem is that it is not clear where the reflection horizon lies; it is often assumed to be the snow-ice interface, but recent experimental research indicates that the horizon can lie within the snow layer, causing additional uncertainty.

Satellite laser altimetry operates in the same way as airborne laser altimetry. The first laser altimetry satellite was ICESat of National Aeronautics and Space Administration (NASA) [17], which has ceased operation with a replacement planned The same problem of conversion from freeboard to thickness occurs as in airborne laser altimetry, but it is at least clear that the echo is coming from the top of the snow layer.

4.5 Recent Submarine Measurements 2007

The most recent large-scale measurements of the Arctic ice thickness distribution were carried out by the author in March 2007 using multi-beam and upward sonar systems mounted on HMS *Tireless*. Figure 4.1 shows the track of the submarine across the Arctic from Fram Strait to a final survey site under the APLIS-07 ice station in the Beaufort Sea; it can be seen that part of the track covers regions that subsequently became ice free during the extraordinary summer of 2007.

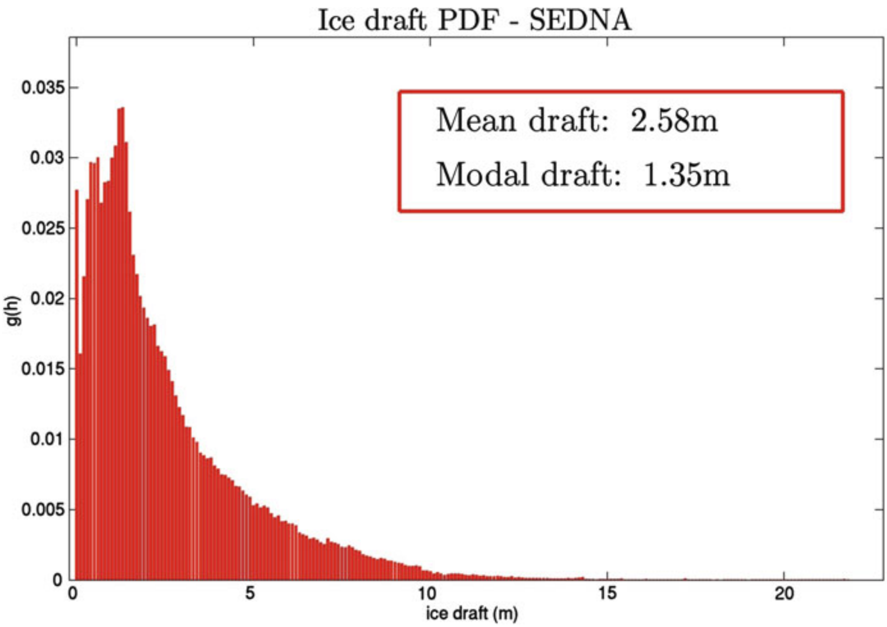

Fig. 4.5 Probability density function of ice draft from 200 km of track in Beaufort Sea, March 2007

The submarine was fitted with a Kongsberg EM3002 multi-beam sonar. This was the first time that 3-D imaging of the under-ice surface has been obtained over long distances by a manned submarine, although in 2004 the author obtained such imagery from the Autosub AUV over shorter distances [50].

Figure 4.4 shows a typical section of multibeam sonar imagery, with a swath width of 100 m. Most of the track consisted of a single swath, but a mosaicking survey was carried out at about 85°N 65°W in a location where surface surveys were subsequently carried out as part of the European Union Sixth Framework Priorities Programme, *Developing Arctic Modeling and Observing Capabilities for Long-term Environmental Studies* (DAMOCLES) project. The structure, shape and topography of pressure ridges is clearly revealed, even though the speed and depth of the submarine meant that the resolution was not as good as has been obtained with an AUV close up to the ice [44, 50].

Figure 4.5 is a probability density function of ice draft from a 200 km section of track obtained using a narrow-beam upward-looking sonar. The location was the Beaufort Sea on the approach to the ice station, at a location which became ice-free in September 2007. It can be seen that the undeformed ice is mostly first-year, with a modal draft of 1.35 m, corresponding to a thickness of about 1.51 m which corresponds well with the results of drilling first-year ice and using an AUV under the ice at the camp. There is a further peak at a lesser draft of about 1 m, due to refrozen leads (again reproducing a typical thickness found by the AUV at the camp), and a gentle peak at about 2.8 m due to undeformed multi-year ice. The subsequent fall-off is the typical negative exponential relationship due to the contribution by pressure ridges to the pdf.

4.6 Global Implications

It appears from the observations of Perovich et al. [24] that the 2007 summer ice retreat was so rapid because a weakened ice cover started to break up with the creation of an unusual number of leads early in the summer. These leads absorbed radiation to warm up the water, producing bottom melt at a rate greater than earlier years. The 1 m and 1.35 m draft components would have melted away completely (Perovich et al. detected 2 m of bottom melt in multiyear ice) while the remainder of the ice cover would have been pushed towards and into Fram Strait by the prevailing wind system of the summer [22]. Given the continued temperature rises due to global warming, it is likely that this process will be repeated and that the summer ice extent will continue to decline rapidly. In fact there was a small recovery in extent during the summers of 2008–2011, but since the mean ice thickness has continued to decrease, the summer ice volume has also continued to monotonically decrease. At a certain point there will therefore be a resumption of the retreat, and the evidence of early summer 2012 (this article written July 2012) is that 2012 may be the year in which the downward trend in summer ice extent resumes.

In considering the large-scale implications of Arctic ice melt, a central question is "how much does the enhanced sea ice melt affect the lower-latitude ocean circulation?" From the Greenland and Labrador Seas the freshwater anomalies from ice melt propagate into to the Nordic Seas, North Atlantic and further in the other parts of the global ocean either through advection or by means of the fast, topographically guided barotropic Rossby and Kelvin waves (e.g. [3]), changing the thermohaline structure. The freshwater storage surplus in the Arctic Ocean due to ice decline and discharge of this anomaly into the global ocean need to be quantified. The estimated runoff gain is ca. 600 km^3/year over the last two decades, compatible to sea ice melt anomaly of 500–600 km^3/year. The current change in the global ocean thermohaline structure is believed to be due to change in runoff, suggesting that the sea ice melt anomaly is still confined to the Arctic Ocean [46]. Eventually, the anomaly could make its way to the lower latitudes, impacting the sea level and Meridional Overturning Circulation.

4.7 Future Measurement Needs

To improve the monitoring needs of the Arctic Ocean, two kinds of technology development are needed. One is to develop existing techniques further to give them the capability for routine basin-wide use. The second is to develop and apply novel techniques that will permit the Arctic Basin to be surveyed rapidly and repeatedly. The most important existing techniques, which still require further validation, are of course satellite techniques. For many years it has been possible to map multi-year fraction as well as total concentration using passive microwave methods (e.g. [8]), but this fraction, expressed within the scale of a large pixel (25 km side), has not been fully validated except by comparison with other satellite methods. Scatterometry is one of these methods, and another is the use of Synthetic Aperture Radar (SAR) to separate ice types. Most important from the point of view of ice volume is satellite altimetry. The first ICESat laser satellite of the NASA obtained extensive data which have not been fully analysed and which can be used in conjunction with available ground, submarine and aircraft data to better assess the ice thickness distribution. This can be taken up further with ICESat-2, due for launch in 2015. CryoSat-2, using a radar altimeter, is now in orbit so it is extremely urgent to fully validate the radar retrievals of ice elevation, and to be confident of the many conceptual steps involved in converting this to area-averaged ice thickness.

Examples of the further development of existing techniques are thus:

(i) Carry out a regional and seasonal survey of mean snow-ice column density over the Arctic in order to allow laser and radar altimetry to be used systematically. At present data on ice density are rather sparse [34]. This could be done in conjunction with airborne altimetry measurements, e.g. using the ASIRAS altimeter which resembles that of CryoSat, in order to achieve a full validation test.
(ii) Carry out further basic research on the scales of variability, both horizontal and vertical, of such parameters as temperature, salinity and crystal fabric in first- and multi-year ice as well as densities as above; and also the scales of such larger-scale features as melt ponds, ridges and leads.
(iii) Carry out further submarine surveys by manned submarine.
(iv) Develop Autonomous Underwater Vehicles with basin-wide capability, basically a problem of battery technology.

Examples of novel techniques would be:

(i) Mounting sonar on a neutrally buoyant float, as already discussed.
(ii) Using acoustic techniques. It has been shown that travel time changes for an acoustic path are reduced by the presence of an ice cover, in most cases by an amount approximately proportional to the ice thickness [11, 14]. In long range acoustic propagation experiments this can be used to give a single mean value for ice thickness along a path.
(iii) Increased efforts to obtain empirical correlations between ice thickness and the output of satellite sensors such as passive and active microwave or altimeter. Already a partial positive correlation between SAR backscatter and ice thickness has been demonstrated [7, 20, 41]. Further advance requires extensive validation studies. A different approach involves matching some informational property of the SAR image, e.g. connectedness of sectors of similar brightness, or distribution of brightness gradients, to $g(h)$ in validated studies between SAR and submarines, in search of quantitative relationships of mathematic form.

An example is the work of Kerman et al. [16]. For one specific ice type, pancake ice, it has been found that the thickness can be successfully inferred from the change in dispersion for ocean waves passing into the ice from the open sea, detected by the Fourier analysis of SAR sub-scenes [49].

(iv) Novel airborne electromagnetic techniques. An example is the use of the radar backscatter co-polarisation ratio at a frequency of 1 GHz (L-band) to obtain the thickness of thin ice.

(v) Deriving ice thickness as a by-product of a proxy measurement. For instance, long distance swell propagation in ice is subject to dispersion that is a function of modal ice thickness (average thickness of undeformed ice). One can obtain the spectrum of flexure from an orthogonal pair of tiltmeters along a wave vector across the Arctic, and derive modal thickness from the arrival times of different frequencies. This has been successfully attempted during the European Union Sixth Framework Priorities Programme, *Developing Arctic Modeling and Observing Capabilities for Long-term Environmental Studies* (DAMOCLES) project [45].

Although the future of basin-wide ice volume monitoring lies with fully-validated polar orbiting altimetry satellites, many climate-related processes can only be studied by in situ monitoring techniques. In particular, under-ice sonar profiles provide vital information on the *distribution* or probability density of ice thickness, with multibeam sonar giving additional 3-D information on the mechanical structure of pressure ridges, the element which makes up about half of the Arctic ice volume. Sonar from vehicles can be accompanied by a programme of moored upward sonar measurements spanning key choke points for ice transport, i.e., Fram Strait, the Svalbard-Franz Josef Land gap and a small number of specimen points within the Trans Polar Drift Stream and Beaufort Gyre. Sonar moorings could well be combined with current meter moorings and sediment traps. The use of military submarines is necessary for these profiles, until or unless AUVs of sufficient range are developed. Valuable additional information can come from airborne laser surveys (again with validation needed) and airborne electromagnetic induction.

4.8 Conclusions

The sea ice cover in the Arctic Ocean is undergoing a transition from being a perennial (year-round) ice cover to a seasonal cover resembling the Antarctic, where most of the ice is first-year and disappears in summer. The trend towards smaller areas in summer, which reached a record low value in 2007, will likely continue, and will eventually lead to an ice-free summer Arctic. Opinions differ as to when this will occur: a recent estimate is in 30 years' time [52], but the accelerating downward trend in ice volume suggests that the change may be more rapid, perhaps occurring in less than a decade (W. Maslowsky, personal communication). The ice cover in the winter Arctic will then be primarily first-year, so that it will be passable by polar icebreakers at any season, with a milder pressure ridging regime which has implications for the design of offshore structures such as drilling platforms. The open water in summer will not only allow unrestricted shipping, but will result in a warmer ocean regime leading to loss of methane from melting permafrost, itself accelerating global warming, as well as increased precipitation over the land masses surrounding the Arctic Ocean and an increased melt rate for terrestrial ice sheets such as that of Greenland. Before it disappears completely we can expect summer ice to be largely confined to a redoubt north of the north coasts of Greenland and Ellesmere Island, and this will then be the only location where substantial multi-year ice will be found.

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Chapter 5
Arctic Climate Change: Security Challenges and Stewardship Opportunities

Kenneth S. Yalowitz

Abstract Climate change in the Arctic is creating complex new security challenges, primarily environmental and political. There is concern that melting Arctic sea ice could trigger a new "great game" of international power politics as nations race to extend their Arctic Ocean territorial shelf claims and extract the abundance of newly accessible natural resources. These concerns are exaggerated in light of the commitment of Arctic coastal states to institutional solutions through the Arctic Council, the *United Nations Convention on the Law of the Sea* and diplomacy. Indeed, there are few, if any, concrete signs of military buildups or increased tensions amongst Arctic coastal states. And, the global economic downturn following the financial crisis starting in 2008 seems to have slowed the economic but perhaps not the strategic pressure for development of Arctic energy and mineral resources. This, however, may only be temporary. All these factors give the international community the opportunity to deal with Arctic security challenges before they result in tension, confrontation and environmental damage.

5.1 Arctic Resources: Fields of National Interests

Several nations have vital interests in the Arctic Ocean and others are expressing a desire to participate more directly in its future. Russia's future economic development has been tied to its northern energy and mineral reserves, and its emerging Arctic strategy focuses on securing and protecting resource development in the Russian north. Russia and Canada are concerned with asserting their national claims over the Northeast and Northwest sea passages, respectively, and monitoring the projected growth of international shipping close to their territory. Apart from naval

K.S. Yalowitz (✉)
John Sloan Dickey Centre for International Understanding, Dartmouth College,
6048 Haldeman Center, Hanover, NH 03755, USA
e-mail: kenneth.s.yalowitz@dartmouth.edu

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operations in the region, United States interests in the Arctic Ocean stem from Alaska's location, the already significant impact of climate change in the far north on the world's environment, development of natural resources, and population, and affirming that sea routes such as the Northwest Passage are international bodies of water. Norway with its associated territories in the Arctic and Denmark because of Greenland also have key strategic interests in the Arctic.

The current scenario is well known. Sea ice, which has covered the Arctic Ocean for millennia, is receding and thinning rapidly, declining 10 % per decade. The traditional way of life of indigenous peoples is drastically changing. There will be open water seasonally across the Arctic Ocean in the near future allowing for significant increases in marine shipping, easier exploitation of the extensive Arctic reserves of oil, gas and minerals and, consequently, greater environmental threats. The impact is not only on the five Arctic coastal states (US, Canada, Russia, Norway and Denmark) but also globally given the closely linked physical systems of land, water and atmosphere to which the Arctic is integral. Arctic fisheries have great importance as a protein supply which could be endangered by uncontrolled fishing or accidental pollution in critical areas.

Recent estimates from the United States [7] indicate that about 30 % of the remaining world undiscovered resources of natural gas and some 10 % of the oil are in the Arctic region. These resources are and are likely to remain costly and environmentally dangerous to extract. The 2010 Macondo blowout or Deepwater Horizon oil spill in the Gulf of Mexico highlights the dangers of oil exploration in water much less challenging than the Arctic Ocean. Also, the world economic recession since 2008, lower expectations for future gas prices when shale gas is exploited more extensively as well as differences between Russia and Norway over fiscal issues have resulted in the slowdown or postponement of important resource development projects such as the Shtokman gas fields in the Barents Sea of the Russian Arctic.

But, global energy security concerns and indirectly the impact of Deepwater Horizon ultimately will reignite interest in Arctic oil and gas development. This was underscored by the recent announcement of findings of potentially significant oil deposits in Western Greenland. BP and Rosneft have agreed to accelerate the exploration of the Kara Sea, though legal issues threaten the project. And Canada, Russia, Norway and Denmark are providing geological information to substantiate their claims for extended jurisdiction over the Arctic Ocean's continental shelves and the natural resources therein.

5.2 International Legal Frameworks Should Ensure Peaceful Management of Disputes

The principal international legal framework for handling and adjudicating territorial and boundary claims is the *United Nations Convention on the Law of the Sea* (UNCLOS) [6], which all Arctic states accept as the appropriate basis for handling them. The United States, however, is not a party; and hopefully, the United States Senate will very soon correct this serious shortcoming. The United States is currently gathering data for possible future extended territorial shelf claims but these would obtain an even stronger basis if the United States accedes to UNCLOS. In practice, current United States Arctic policy fully recognizes the importance of the UNCLOS and is in accordance with its general framework.

Some international Arctic governance is provided by the Arctic Council, an intergovernmental forum consisting of eight Arctic states (the five Arctic coastal states as the most influential "core" states, plus Finland, Iceland and Sweden), six permanent participants (indigenous peoples' organizations, principally among them the Inuit Circumpolar Council) and observers. The Council and its bodies have played an important role in focusing attention and drafting scientific and social assessments of environmental and climate-related issues, but the Council has no enforcement mechanism and security and political issues are excluded from its purview. A new binding Arctic council Arctic search and rescue agreement [1] is an important development. Asia is clearly affected by developments in the Arctic region but no Asian country is an Arctic Council member. Neither is the European Union.

Some political observers see this situation as ripe for a new "great game" in which the contending powers will inevitably come to blows over dividing the new riches. They have called for a new international agreement perhaps along the lines of the Antarctic Treaty System, which since 1959 has frozen territorial claims in the Antarctic and demilitarized the area, saving it for scientific research. Others believe that such a new international accord is unlikely given that the leading Arctic states do not support it, there already is a high level of economic development and resource extraction in the Arctic region, and the situation is too fluid to capture in a new international accord. They believe the Arctic Council functions effectively and that global and regional institutions, primarily under UNCLOS, can provide flexible and timely leadership in dealing with environmental security and climate-related issues. Further, existing mechanisms such as the International Maritime Organization and regional fisheries commissions provide a regime structure that can deal with issues related to maritime traffic, oil spills, search and rescue and fisheries.

The Arctic coastal states also believe that the UNCLOS provides the legal framework for managing Arctic Ocean territorial shelf disputes. UNCLOS is not perfect; it leaves large portions of the Arctic Ocean unclaimed and some smaller zones have the potential for overlapping claims. But the *Ilulissat Declaration* [3] of the five Arctic coastal states (and subsequent statements) declares the UNCLOS to be the mechanism for resolving boundary and extended territorial shelf claims. The 2010 decision of Russia and Norway to end a 40-year long dispute by agreeing to divide the Barents Sea and part of the Arctic Ocean into clear economic zones was a welcome indication that affected nations wish to resolve such questions by diplomacy and adherence to UNCLOS. This agreement also likely sought to create a positive environment for joint ventures and the development of Russian Arctic resources in cooperation with non-Russian businesses. Then Russian Prime Minister Vladimir Putin [5] said that the Arctic should be "*a zone for peace*" and that the only way to deal with rival territorial claims was through negotiations in compliance with international law. The disagreement between the United States and Canada over whether the Northwest sea passage is an international or national (Canadian) right of way is limited to diplomatic exchanges.

5.3 Emerging Risks

Indeed, despite some heated rhetoric and a spate of press articles warning of inevitable tensions and conflict, there are no large geopolitical fault lines in the Arctic region and no resource wars on the horizon. Significantly, most energy reserves are located in the 200 nautical mile nationally controlled Exclusive Economic Zones and thus not subject to international dispute. The declared policies of the major Arctic states all underscore the multi-faceted importance of this region, their desire for cooperation in scientific and environmental research, their commitment to dialog, the importance of UNCLOS to resolve territorial and boundary claims, but their determination to secure and defend their economic and political interests. Zero-sum language has not been heard.

Large- scale damage to the Arctic environment from transportation accidents, energy development, and pollutants from the South poses a much greater immediate threat to the Arctic ecosystem, human security and health, and national priorities than classic security issues. A number of bi-national agreements, regional regimes and international treaties, such as the *Convention on Persistent Organic Pollutants* [4], provide a level of protection, but a comprehensive international strategy for sustaining the Arctic environment, including the key global concern of climate stabilization is still lacking.

Nonetheless, there are steps for international cooperation which could help transcend the legacy of Cold War confrontation in the Arctic. These can be seen in the easing of border restrictions between Norway and Russia and in joint projects of these two countries requiring complementary competences and resources such as offshore drilling technology or icebreaker support. Under UNCLOS, areas beyond the 200-mile Exclusive Economic Zones of the five Arctic coastal states and legally separated from the sea floor are high seas open to all. Recognizing this zone in the central Arctic Ocean as a place of peace and international cooperation based on shared environmental security interests would be an another important measure.

Russian authorities have indicated their intention to establish five new specially protected areas in the Arctic, one of them in the Barents Sea. And Russia and the United States reportedly are working together towards the establishment of a large natural park which is to stretch over both parts of the Chukotka Peninsula and Alaska.

5.4 Ensuring Military Preparedness for Coordinated, Non-military Missions

The military forces of the Arctic states operating in the region serve two main purposes. The first is to underline their respective territorial claims but without any detectable will to escalate, and the other is to prepare and exercise for search and rescue missions, monitoring and surveillance, ship assistance, etc., activities currently requiring military assets and capabilities. With generally tight defense budgets in the countries of the region, such activities are more likely to stay at current levels.

That said, there does seem to be a role for national militaries to cooperate in helping deal with environmental security impacts of climate change in the Arctic and worldwide. The United States military is already focused on the significant role climate change will have in shaping the future security environment. According to the United States *Quadrennial Defense Review* [9] of February 2010, climate change will contribute to global poverty, environmental degradation and further weakening of fragile governments. While climate change alone does not cause conflict, the Report states it could accelerate instability or conflict, placing the burden to respond on civilian institutions and militaries around the world. Extreme weather events could lead to increased demands for defense support for humanitarian assistance or disaster response within the United States and overseas. According to the Report, The Defense Department and other United States government agencies are already working with many countries to help build their capability to respond to such events. An integral part of the United States Navy's worldwide response to climate change is its comprehensive *Arctic Roadmap* [8] program which focuses on cooperative and transparent approaches to dealing with environmental, shipping and communication issues in the Arctic region. The Roadmap does underscore the need to protect United States security interests in the Arctic but does not point to any imminent military buildups or threats. It strongly supports United States accession to the UNCLOS and cooperation in promoting scientific research and environmental security.

Given the dearth of such assets in the North, naval cooperation in communications, disaster planning, and search and rescue operations would help address the serious risk of a cruise ship or commercial vessel going down in the Arctic Ocean. The military could also support studies to lessen the risks of maritime pollution and oil spills. And research on ice thickness and melting could be shared with civilian counterparts.

5.5 Conclusion and Recommendations

Those of US with extensive government service understand it is very difficult to get policy makers and legislators to focus on future threats such as Arctic climate change when they have so many current crises with which to deal. The problem is compounded when scientific models cannot, by the nature of the problem, give precise predictions of tipping points and times for change. And economic and fiscal issues may cause officials and legislatures to shy away from the high costs of preventive and remedial action.

The most important single priority remains to reach binding international agreement to limit carbon emissions and stabilize the climate. The challenging diplomatic work with China and India over carbon emissions must continue. The Arctic Council is best placed to provide the science needed to assess Arctic policy and the impact of policies on the Arctic region, but the Council's influence at Arctic and international levels needs to be strengthened. A permanent Arctic

Council secretariat could provide that focus and integration now that it has been agreed. China and Japan have *ad hoc* observer status in the Council but they should have greater representation along with the European Union. The interests of indigenous peoples also must be more effectively represented at the Arctic Council. And the Government of Finland [2] has proposed in its newly issued Arctic strategy an Arctic summit meeting. Such a meeting would need to be well prepared, but the idea has considerable merit.

In the end, much will depend on informed citizenry demanding action on climate change by their national governments and legislatures, and leaders demonstrating political will in the face of opposition. The dissemination of sound scientific data and informed discussion in all our countries is essential and gives hope that out of this meeting on Environmental Security in the Arctic Ocean will come a dialog between science, the academy and policy makers on facing the economic and political security effects of climate change in the North.

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Chapter 6
Sustainable Development Considerations in the Arctic

Nikolaj Bock

Abstract The Arctic region is affected by climate change through accelerated melting of snow, ice and permafrost. The consequences include biodiversity loss, disruption to ecosystems, migrating fish stocks, coastal erosion, land use changes and global sea level rise. Some of the drivers of change are global mega trends beyond the control of the Arctic states, such as population growth and growing demand for natural resources, the state of the world economy, changing trade patterns, commodity prices or global climate change. International cooperation is needed to address the global drivers, but when it comes to ensuring sustainable development in the Arctic, most of the responsibility lies with the Arctic states as most of the economic activities take place on their land or in their coastal waters. Large-scale economic activities have been taking place for decades, through extraction of natural resources, fisheries, shipping or forestry. However, the Arctic environment is still considered clean not least due to the relatively low level of human activities this far. But with an increase in human activities – coupled with other stressors – action is needed to safeguard the environment, to ensure a sustainable development and maintaining the ecosystem services that the region provides for the local population as well as for the globe as such. Creating job opportunities and allowing for industrial activities are not incompatible with safeguarding a sustainable development as long as the necessary measures are in place to protect the environment and to avoid accidental effects from increased exploitation of the living and non-living resources.

N. Bock (✉)
International Affairs, Executive Directors Office, European Environmental Agency,
Kongens Nytorv 6, Copenhagen K DK-1050, Denmark
e-mail: Nikolaj.Bock@eea.europa.eu

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6.1 Introduction

The Arctic region[1] makes up more than 15 % of the planet but with only four million people – a quarter from indigenous groups – it is one of the least populated areas on Earth. For centuries, most of the world has regarded the Arctic as a harsh, inhospitable place on the globe's periphery. Over the last decade, however, the region has received increasing international attention, not least due to the effects of climate change, where melting sea ice is opening access to natural resources and new shipping routes or because the Arctic is contributing to global sea level rise from the melting Greenland ice cap.

The increasing focus on the Arctic region's economic development inevitably raises fears about the resulting social and environmental impacts. And it likewise raises the question of whether the Arctic can serve as a region where sustainable development can be proven as a valid and guiding principle to help avoid the problems that have arisen elsewhere in the world. Many argue that development in the Arctic region (and elsewhere) must not deplete natural stocks of capital and lessen their capacity to deliver valuable ecosystem services. Arctic ecosystem resilience must be maintained or even improved if possible.

Since the former Norwegian Prime Minister – Gro Harlem Brundtland – argued for sustainable development in the United Nations report that emerged from her leadership [19], it has become apparent that human development and economic growth has placed enormous strains on the global ecosystems through population growth and use of the natural resources. The report successfully argued that economic growth needs to be decoupled from ecosystem degradation and that unsustainable patterns need to be reversed. It is now almost 20 years since world leaders embraced the term and set up the United Nations Commission on Sustainable Development in 1992 and agreed on Agenda 21. Of course, the essential question is, whether the eight Arctic states[2] – all developed industrialised countries – have grasped the importance of the concept and applied the principles in their management regimes and strategies for the Arctic; not just on paper and through setting up structures like the Arctic Council, but also in practice. The outcome from the Rio+20 Summit in June 2012, "The Future we Want", confirms the urgency of putting in place these regimes and strategies.

Although the concept of sustainable development – with its balancing act of integrating economic, environmental and social aspects – are key to most policy developments, including in the Arctic states and in the international arena, achieving it is easier said that done. This chapter will address some of the key considerations that should be addressed and incorporated into policy developments when considering sustainable development in the Arctic.

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[1] The Arctic region is here defined as the region North of the Arctic Circle (66.5° North latitude).

[2] Canada, Denmark/Greenland/Faroe Islands, Finland, Iceland, Norway, Russian Federation, Sweden and United States of America.

6.2 The Arctic Region

Although the title of this book relates to the Arctic Ocean, this chapter will be encompassing the Arctic region as a whole – which includes the central Arctic Ocean, the surrounding regional seas and the bordering land masses – as the state of ecosystems and economic activities taking place at sea or in the catchment areas on land are all interconnected and cannot be discussed in isolation.

Large-scale economic activities in the Arctic have been taking place for decades, through extraction of hydrocarbons and minerals, fisheries, shipping or logging (Fig. 6.1). Despite these activities, the Arctic environment is still considered relatively clean, not least due to the relatively low-level of human activities thus far due to the harsh and demanding conditions for industrial development and through

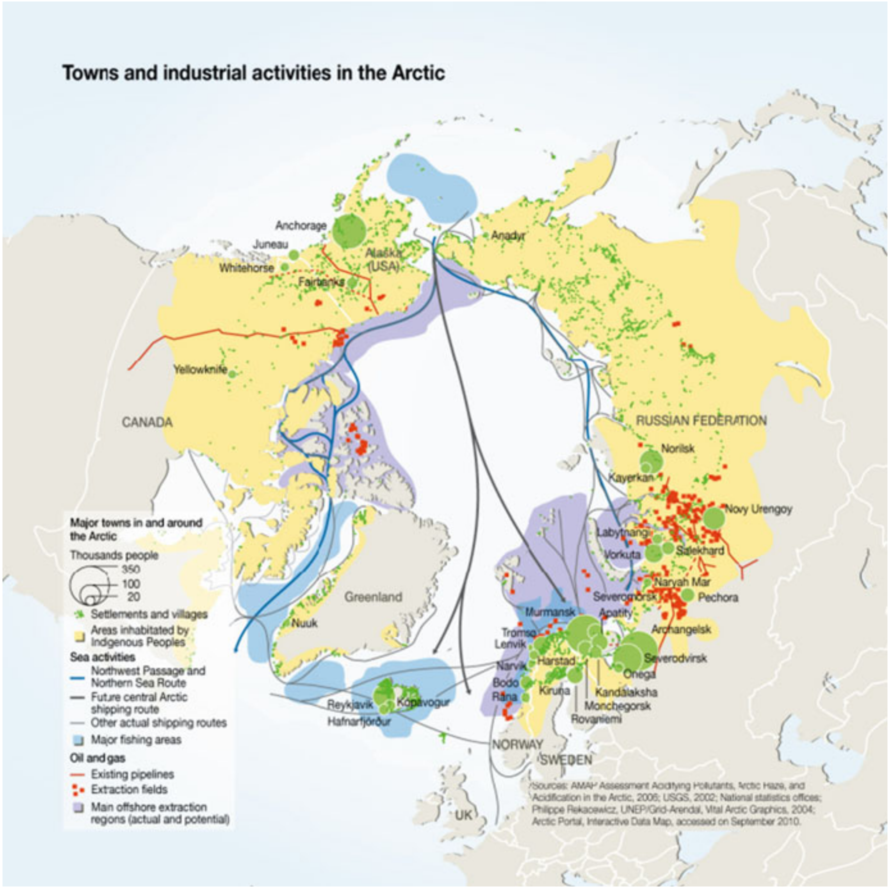

Fig. 6.1 Towns and industrial activities in the Arctic. From the UNEP/GRID-Arendal Maps and Graphics Library (http://maps.grida.no/go/graphic/towns-and-industrial-activities-in-the-arctic. Accessed 20 Aug 2011)

the stewardship of the local and indigenous population. However, with increased human activities and a changing Arctic due to climate change, caution is needed to safeguard the resilience of the Arctic environment and to ensure a sustainable development in the region. Because if human activities triggers a state change or crosses tipping points in Arctic ecosystems the long-term consequences might be severe and hamper efforts to achieve a development path that is sustainable.

There are large differences between the countries in the Arctic in terms of size, population, economies, climate, culture, legislation and governance system and this should be kept in mind when discussing the Arctic as a region or when addressing strategies and approaches towards sustainable development. It should also be noted that there is no major 'governance vacuum' in the Arctic, as some suggest, as national legislation, bilateral agreements and international conventions and protocols apply[3] to the Arctic and already create a comprehensive framework for governing all relevant human activities. However, although Arctic governments already have policies in place to address most of harmful environmental impacts, both within the Arctic and globally, some impacts are not completely addressed[4], and a number of policy initiatives could raise the baseline on safeguarding the Arctic within the overall framework. Such action would also contribute towards an integrated management of the natural capital, helping to avoid passing on to future generations' risks from today's inadequate governance of natural resources or increase the understanding of the ecological consequences of today's large-scale activities. Because a complete and comprehensive understanding of Arctic ecosystem resilience is not yet available to policymakers or industries operating in the Arctic.

6.3 Megatrends and Drivers of Change

When discussing sustainable development – in the Arctic or elsewhere – it is important to understand the pressures and drivers of change, the current state of the system as well as identifying the key indicators that will mark systemic and potential detrimental changes, before the appropriate responses and actions are devised and implemented.

A number of drivers and trends affect the Arctic region, the environment and its people. Some of these drivers of change are global challenges that Arctic states are not solely responsible for or can solve alone. An example is climate change which is a major driver to changes in the Arctic, and although the Arctic states are responsible

[3] Examples include the *United Nations Framework Convention on Climate Change* (UNFCC), *United Nations Convention on Biological Diversity (CDB)* and *Convention on Long-Range Transport of Air Pollutants* (LRTAP).

[4] Although work is ongoing, there are for example no current legally binding global instrument for regulating heavy metals like mercury, which have pathways into the Arctic. Similarly work is ongoing through the International Maritime Organization, but there is not today a comprehensive mandatory shipping code for ships operating in ice-covered waters. New harmful substances could also be added to the *Stockholm Convention on Persistent Organic Pollutants*.

Box 6.1 Global Megatrends [10]

- Increasing global divergence in population trends
- Urbanisation
- Disease burdens and the risk of new pandemics
- Accelerating technological change: racing into the unknown
- Continued economic growth
- From a uni-polar to a multi-polar world
- Intensified global competition for resources
- Decreasing stocks of natural resources
- Increasingly severe consequences of climate change
- Increasing environmental pollution load
- Environmental regulation and governance: increasing fragmentation and convergence

for a proportion of global greenhouse gas emissions, solving the problem cannot be tackled by Arctic states in isolation.

The same holds true for some of the other important drivers and global trends that will affect the Arctic region and that potentially will undermine attempts to ensure a sustainable development in the region. Some of these other drivers and global megatrends beyond the control of the Arctic states include: global population growth, growing demand for natural resources, the state of the world economy, changing trade patterns, world prices on key commodities (oil, gas and minerals) and increasing environmental pollution loads (Box 6.1).

When addressing the future of the Arctic and seeking a sustainable development there is an increasing need to acknowledge these drivers and understand how they will shape or affect national or regional measures as the global megatrends[5] cut across economic, social, political, technological and environmental dimensions. Integration of global markets, shift in regional competitiveness, economic power shifts, lifts in purchasing power in Asia and new technologies will all fuel the future demand for resources and the detrimental effects on the environment, human health or degradation of the capital stock. All are part of complex interactions that are difficult to predict or counter balance, and sadly, there are no easy quick-fix solutions or technological breakthroughs to solve these problems at once. And without proper mechanisms of incorporating sustainable development considerations into the economic development of the Arctic region, any further economic development could exacerbate environmental pollution and ecosystem degradation.

[5] Understanding and taking into account the global megatrends enables governments to better understand the various driving forces and their influences to identify plausible future scenarios that can be used to devise strategies.

6.4 Climate Change a Key Driver in the Arctic

As mentioned in the introduction, one of the primary reasons for the increased world attention on the Arctic is due to the dramatic effects by climate change through accelerated melting of snow, ice and permafrost which opens up the Arctic to further hydrocarbon exploration and increased shipping. But also because a changing Arctic is projected to enhance further global warming due to the decreasing albedo effect (white snow/ice covered areas reflecting sun are decreasing and dark surfaces will increase and absorb more sun energy) and possibly increasing methane releases – a powerful greenhouse gas – from thawing permafrost. In addition the Arctic is contributing to global sea level rise through the melting ice cap on Greenland [2].

The global mean temperature in 1990 was about 0.6 °C higher than in pre-industrial times (1850–1899) and in 2009 this increase was about 0.7–0.8 °C. Projections show that global mean temperatures could increase by 1.1–6.4 °C from 1990 [12]. Thus an increase above 2 °C[6] could occur in the coming century if global greenhouse gas emissions are not reduced – with even higher regional temperature rises like in the Arctic – has opened the eyes of the world to the fact that humankind are having a detrimental impact on the planet and that urgent and comprehensive action is needed to sustain our current way of life. Unfortunately, it has until recently been less clear that the consequences of irreversible damage to ecosystems are too great to handle and the cost of inaction outweigh the investments needed to rectify the problem. The classic phrase *'ounce of prevention is better than a pound of cure'* seems to fit.

In general, the scientific community has already raised the red flag and warned that it is plausible that Arctic climate change will cause precipitation patters to change, sea ice extent and thickness to diminish, biodiversity changes to occur, disruption to ecosystems to happen, migrating bird and fish stocks to be affected, invasive species to change the Arctic species composition over time, that coastal erosion might increase due to less buffering sea ice and that large-scale land use changes will happen if current logging practices and expansion of infrastructure continues. Policy makers are in other words being warned that climate change is likely to lead to major changes in Arctic ecosystems which could reach dangerous tipping points that could affect global feedback systems with repercussions that will be felt globally and not just in the Arctic [1].

Even with the 2010 climate change agreement reached at COP16 in Cancun, Mexico, it will unlikely lead to a halt in the current decline in sea ice extent/thickness and thawing permafrost due to the emissions of greenhouse gasses already released into the atmosphere and the projected trends for further emissions (Fig. 6.2). However, due to the complexity of the climate system, exact projections are not possible. Regardless of the exact scenario that will play out, climate change is expected to have particularly pronounced impacts in the Arctic and this complicates efforts

[6] The UNFCC 16th Conference of the Parties (COP16) in 2010 recognised the need for deep cuts in global greenhouse gas to hold the increase in global average temperature below 2 °C above pre-industrial levels.

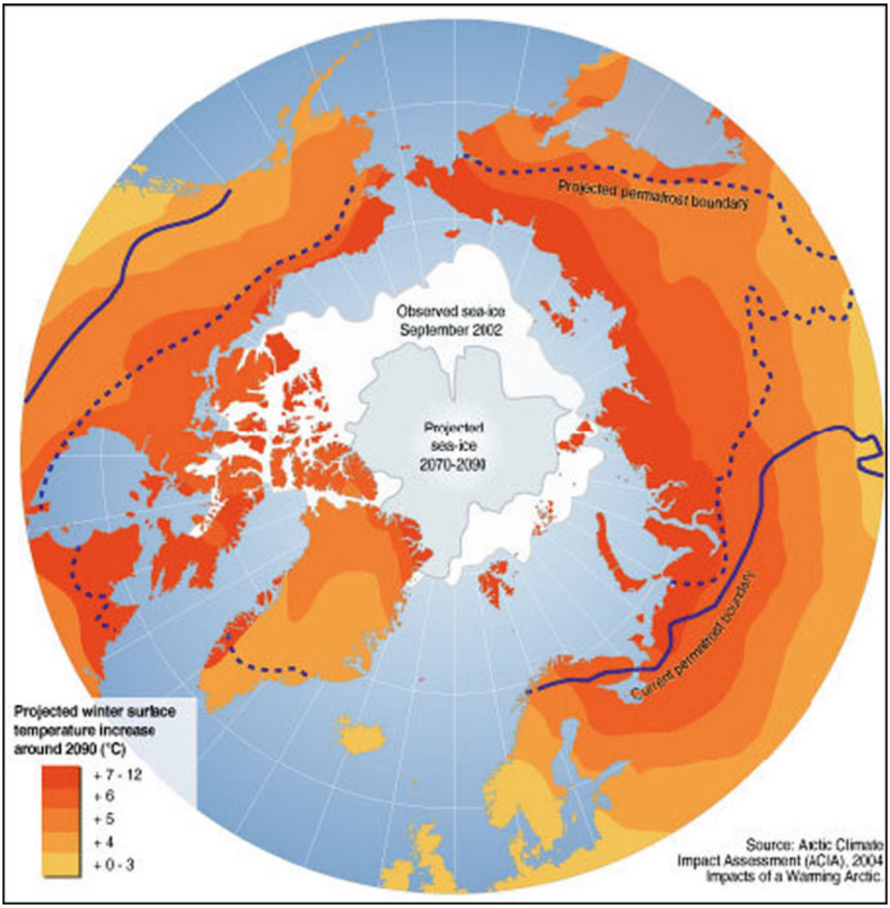

Fig. 6.2 Projected changes in the Arctic climate through 2090. From the UNEP/GRID-Arendal Maps and Graphics Library (http://maps.grida.no/go/graphic/projected-changes-in-the-arctic-climate-2090. Accessed 20 Aug 2011)

on achieving a development that is sustainable, as this driver will influence a large number of other key factors and trends.

6.5 Arctic Resources and Pressures on Ecosystems

Arctic states have a natural interest in seeking the right balance when it comes to ensuring their economic development. This means both meeting the growing global demand for resources and finding sustainable national and regional strategies for managing the natural capital that will secure growth now and in the future. As an example, some 11 % of the Russian Federation's gross domestic product (GDP) is generated in the Arctic part of the country and Russia therefore has self-interest in ensuring a sustainable flow of resources from the North rather than depleting the stocks on a short-term basis. European consumption already exceeds its own renewable natural resource production and demand for materials is so intense that between 20 % and 30 % of the resources used in Europe are now imported. Continued economic growth and stability in Europe therefore depends on imports from other parts of the world including the Arctic region. And in order to sustain such future demands a balanced approach and management of Arctic resources is required.

The demand for Arctic resources creates a variety of challenges and the list of issues and considerations that needs to be incorporated into sustainable strategies and management plans is long and includes pressures on ecosystems from climate change (as mentioned above), exploration of minerals and fossil fuels, increased shipping, over-harvesting of key fish stocks, local and long-range pollution, pollution incidents from industrial activities and historical waste disposals, land fragmentation and impacts from infrastructure developments, decline in biodiversity and threat from invasive species, or pressure from tourism.

Below is a brief introduction to some of these challenges that nationally and collectively will have to be addressed by the Arctic governments and their industries in addition to the global megatrends that also has to be taken into account. Only a brief overview of the key issues will be presented as each of these topics will be addressed more comprehensively in other chapters of this book.

6.6 Hydrocarbon Exploitation in the Arctic

The global demand for energy is continuously rising [11] despite efforts to reduce consumption, to improve efficiency and to shift to renewable energy resources. The Arctic has over the past decades seen an increase in the exploration and extraction of hydrocarbons [1] to meet those needs, not least from Europe with its increasing reliance on fossil fuel imports to meet energy needs. Growth in the energy sector will create employment opportunities and economic development in the Arctic region, which has been welcomed by many.

However, the increased number of large-scale activities, such as the development of the natural gas sector on land or development of shale gas or oil sands are putting traditional livelihoods and practices, like reindeer herding and hunting/trapping, under pressure through pipeline development and new production fields. Also at sea, such large-scale activities can influence fishing grounds or the migration of sensitive marine species, not least as seasonal patterns of species migration and breeding make Arctic systems very vulnerable and add importance to the timing and impacts of oil and gas activities.

Thus far, growth in the Arctic energy sector has primarily concentrated on oil and gas reserves on land and in shallow coastal waters. But with the opening of Arctic waters due to climate change, the industry is now turning to promising fields further offshore and at increasing depth. Although great advances in technology and experience in Arctic hydrocarbon extraction has been made over the recent decade, there is still substantial risks involved with offshore and deep water drilling in the demanding Arctic conditions with drifting ice, storms, darkness and remoteness. The *Deepwater Horizon* oil disaster from the Mexican Gulf in 2010 is an unfortunate reminder how problematic deep water drilling can be in even more favourable conditions. While the technological challenges regarding deep offshore Arctic exploration still remain unresolved – this will limit production in the deeper parts of the Arctic Ocean, at least for the time being.

Getting the extracted hydrocarbons – in the form of gas, oil or liquefied natural gas – out of the Arctic and safely delivered to consumers further south, be it on ships or through pipelines, also present a complex set of environmental, social and legal challenges that industry and government has to take into consideration.

6.7 Arctic Shipping

The 2009 comprehensive assessment of Arctic shipping by the Arctic Council [4] gave an overview of the current and projected shipping traffic in the Arctic and highlighted some of the potential risks and challenges that need to be addressed when shipping increases further as a result of reduced summer sea ice cover in the Arctic, increased export of natural resources, fisheries or cruise tourism (Fig. 6.3). Shipping has a great impact on the environment through emissions, accidental or deliberate spills, noise and disturbance of sensitive breeding grounds for certain Arctic species. With the AMSA reports projected increase in both oil tankers and cargo ships to and from the Arctic as well as across the Arctic through the Northern Sea Route or the Northwest Passage – coupled with increased fishing and cruise ship tourism – the impacts on Arctic ecosystems and thereby on the livelihood of the local population will be increasing.

Efforts are being made to limit the risks of pollution and to introduce a mandatory shipping code for Arctic vessels at the International Maritime Organisation. The proposed polar code being discussed in International Maritime Organization (IMO) – or more formally called *'Enhanced Contingency Planning Guidance for Passenger Ships Operating in Areas Remote from Search and Rescue Facilities'* – is using a risk-based approach including the development of goals and functional requirements which will be accompanied by prescriptive provisions. However, the adoption of such a polar code will not alone be sufficient to enhance Arctic marine safety and protecting the Arctic people and the environment. But by following the additional 17 recommendations from the AMSA report will however, be a step in the right direction towards meeting these objectives and contribute towards a sustainable development in the Region.

More work is also needed in regulating the harmful emissions from ships, including smoke and particulate matter – also refereed to as Black Carbon – that accelerates the melting of snow and ice and thereby contributes to the regional impacts of climate change. Ongoing efforts have also been initiated to strengthen the search and rescue capabilities in the Arctic through the agreementthat was signed on 12 May 2011 [5], which hopefully will lead to improved prevention and management of incidents in the Arctic. However, such efforts are naturally aimed at saving lives

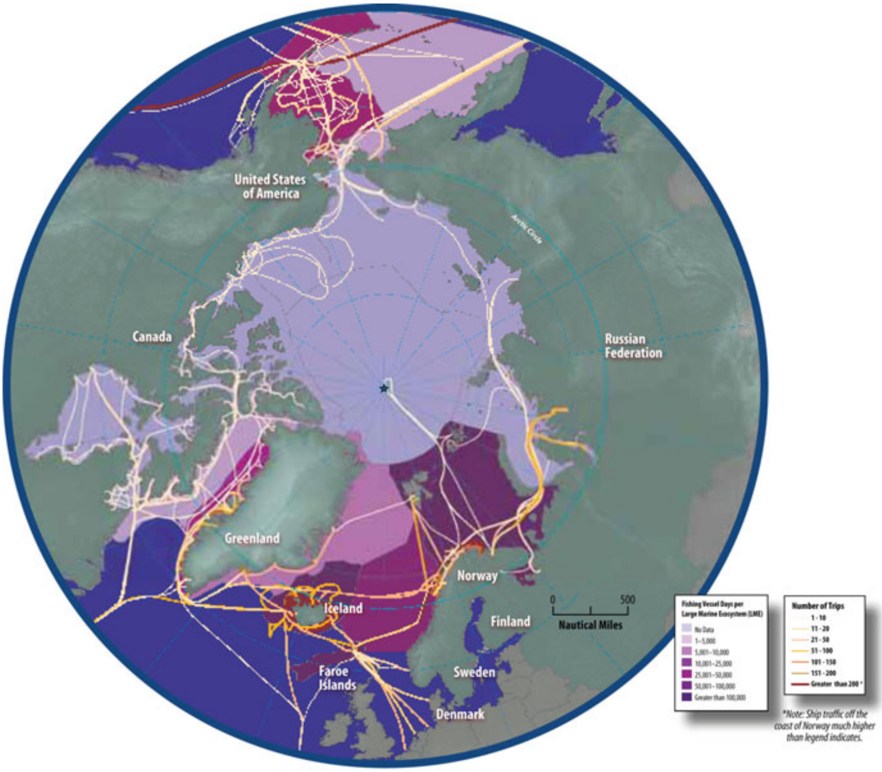

Fig. 6.3 Arctic Ocean shipping traffic in 2004. From AMSA (2004)

first and safeguarding the environment will become a secondary priority. With time, hopefully appropriate measures will ensure that also timely and effective capabilities of protecting the marine living resources and the environment will also become available, as Arctic ecosystems, livelihoods and job opportunities are at risk from major accidents in the sensitive Arctic waters.

6.8 Arctic Fish Stocks

Fishing and management of fish stocks is also a challenge for the Arctic region as the marine environment is under pressure from climate change and the many human activities apart from fisheries such as: off-shore extraction of oil and gas, sand and gravel extraction, shipping and offshore wind farms. Pollution is also increasingly becoming a problem, both from local discharges via river runoff or from coastal industrial sites and from long-range pollution through ocean and atmospheric currents from distant sources. Similarly ocean acidification is changing the species composition, particularly through changes of phytoplankton (as the main base for

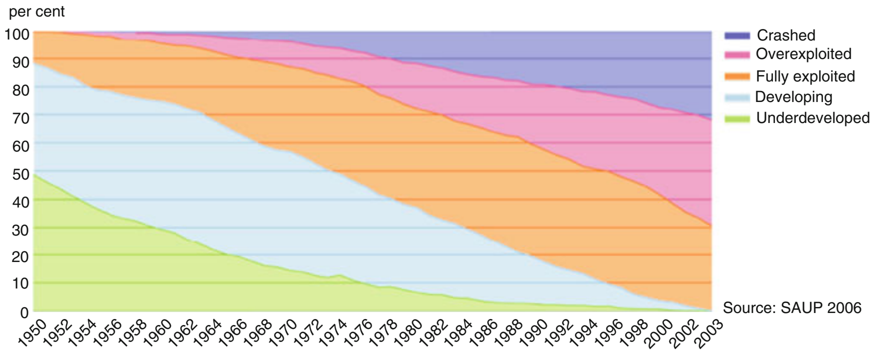

Fig. 6.4 Exploitation status of global marine fish stocks. From the UNEP/GRID-Arendal Maps and Graphics Library (http://maps.grida.no/go/graphic/exploitation-status-of-marine-fish-stocks. Accessed 20 Aug 2011)

any marine food chain) from calcareous to siliceous skeleton species but also through changes to the zooplankton.

Fish is often the primary source of income and food source for many coastal communities in the Arctic, but overfishing is threatening the viability of both. Overfishing is a huge problem and globally some 70 is required % of the key commercial fish stocks are considered to have collapsed or to be overfished (Fig. 6.4). Although the entire Arctic basin has been less intensively overfished compared with over regions of the world, recent studies have indicated that total catches from the parts of the Arctic region are 75 times bigger than reported to the United Nations Food and Agriculture Organization when including small-scale and local catches [20].

Mismanagement and overfishing not only reduces the total stock of commercial species, but it also affects the age and size distribution within fish populations. This has the potential to disrupt the species composition of large marine ecosystem as the major commercial species are linked ecologically, and extensive harvests on one of them might affect the future possible harvests on the other species. This applies to fisheries in the Arctic regional seas as well, where the key Arctic fish species commercially harvested is concentrated on cod, herring and capelin from the Barents and Norwegian Seas. Arctic fisheries are in addition affected by climate change, which has changed the distribution of certain fish species further north. Also invasive species like the King crab can place further pressures on the Arctic ecosystems. The collapse of the Canadian cod fisheries in the Atlantic in the 1990'ies is an example of how certain fish stocks react to a multiple of external pressures. It has been argued that fisheries management in the Arctic region is not yet fully integrated and ecosystem based, that further governance and that present enforcement and regulation is incoherent and incomplete. In the interest of achieving sustainable Arctic fishery levels, further coordination efforts are to be encouraged across national jurisdictions and by Regional Fisheries Management Organisations (Fig. 6.5). If Governments fail to adopt to climatic changes, ensuring evidence-based

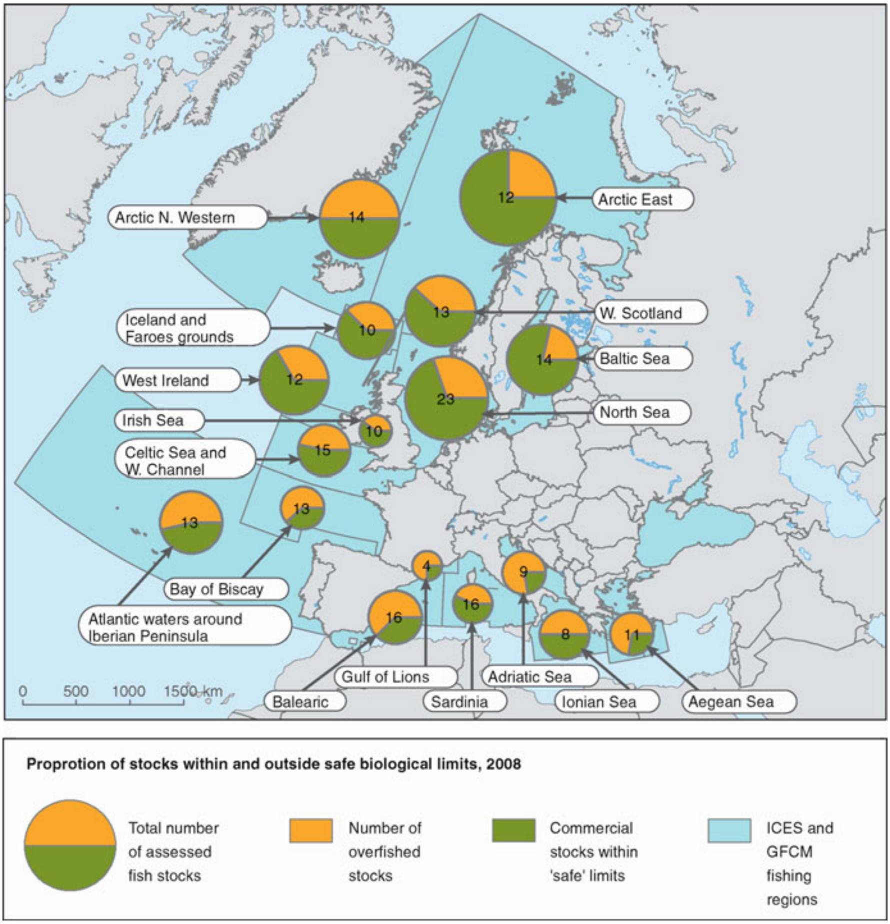

Fig. 6.5 Proportion of fish stocks in the North Atlantic region that are within and outside safe limits. From the European Environmental Agency (http://www.eea.europa.eu/soer/synthesis/synthesis/chapter3.xhtml. Accessed 20 Aug 2011)

fishing quotas and reducing Illegal, Unreported and Unregulated (IUU) fishing in the Arctic, food security can ultimately be threatened.

6.9 Arctic Pollution

Although only four million people live in the Arctic, major economic activities with widespread impacts on the environment have been taking place in the region for decades. Such activities coupled with unsustainable waste disposal practices, diffuse pollution loads through river run-off or discharges from contaminated sites all contribute to an increasing pollution load in the Arctic. A number of historic pollution hotspots, not least in the Russian Arctic, have been identified but the cleanup will take decades depending on the available resources for the costly restoration projects. In addition to the local and regional pollution loads are long-range transboundary pollution, which further adds pressure to the Arctic ecosystems resilience and capability to absorb and degrade the pollution loads.

Although international efforts are being made to regulate harmful substances – for example through a legally binding instrument on mercury, strengthening the *Convention on Long-Range Transport of Air Pollutants* or through a number of European Union efforts (e.g., directives on National Emission Ceilings and Integrated Pollution Prevention and Control) – long-range pollution from mercury, radioactivity or persistent organic pollutants continue to enter the Arctic region through ocean currents and atmospheric deposition [3]. The influx of such pollutants poses risk to the environment as many of the pollutants accumulate in the Arctic due to the slow biodegradation processes in the cold conditions. Although the Arctic is still considered a clean and unspoiled part of our world, pollution loads are increasingly affecting Arctic human health and might over time affect the food safety for the local and indigenous population relying to a larger extent on locally derived food rather than imported food.

As economic activities are likely to increase in the decades to come, more focus could be aimed at preventing further harmful substances entering and accumulating in the Arctic ecosystems and food webs creating cascading effects in the Arctic food chain. It should also be noted that climate change will be a contributing stress factor, as the increasing annual melting of snow and ice will every summer lead to large spikes in the release of substances captured in the cryosphere over the winter period or through historic deposition in older ice layers [16].

6.10 Land Use Changes

Land use and land use changes in the Arctic play a major role in the resilience of the Arctic ecosystem and the ability of the system to withstand the pressures from climate change, not least when it comes to influxes of sediment, nutrients or harmful substances into the Arctic basin through river runoff. This is the result of for example timber and logging practices, land fragmentation through the construction of transport infrastructure or expansion of pipelines. All such activities affect Arctic terrestrial ecosystems and coastal waters through runoff. The impacts through land use changes needs to be addressed, including strategies on managing forest fires, handling of industrial accidents or managing toxic waste disposals in the Arctic. Large-scale land-use change through thawing permafrost (inland and in coastal regions) is also an area of concern due to the release of greenhouse gasses, methane and CO_2, costal erosion or possible destruction of infrastructure.

6.11 Arctic Biodiversity

Arctic biodiversity and ecosystems are under increasing pressure. Preservation of biodiversity and maintaining ecosystem services is fundamental to human well-being and continued access to natural resources and economic growth. It can be argued, that if today's environmental resources – air, water, soil or biodiversity – are not properly managed, it could have security implications on a broad scale in the future through a reduced ability to sustain people and economies in good health. Despite progress in some areas, the United Nations 2010 target of halting the loss of biodiversity has neither been met globally nor in the Arctic, as the recent report on Arctic biodiversity [7] have highlighted with declining trends in both marine and terrestrial species. The importance of biodiversity and ecosystem services for economic development, human health and job creation must not be underestimated. Spatial planning, resource accounting and coherence among sector policies also need to be implemented at all levels in order to ensure that natural capital is preserved to fuel economic growth and Arctic livelihoods.

Arctic changes in ocean circulation, temperature, salinity, productivity or sea ice extent may have important implications for species success or survival, the control of invasive species and ecological functions. Arctic marine and coastal areas are increasingly being protected, but still yet only cover less than 5 % of the Arctic coastline. Further work is therefore needed in designating areas of ecological significance, e.g. designation of Particularly Sensitive Sea Areas in international waters or through national designation of protected sites and marine areas in coastal waters that will avoid impacts on vulnerable Arctic species or limit impacts on migrating animals like, birds, fish and marine mammals.

6.12 Increasing Arctic Tourism

Although concentrated in specific regions such as Svalbard, Greenland and South Alaska tourism is on the rise in the polar regions [15], and an increasing number of tourists enter the Arctic on ever-larger cruise ships. An increasing number of particular large cruise vessels are not properly equipped, designed or used to operating in ice covered waters and the search and rescue facilities are currently inadequate to cater for a large-scale accident in the uncharted Arctic waters. Although the 2012 *Agreement on Cooperation on Aeronautical and Maritime Search and Rescue in the Arctic* signed under the auspices of the Arctic Council will improve the emergency coordination of possible incidents, the infrastructure and available rescue vessels in the vicinity is not likely to improve any time soon. Arctic nations therefore need to be attentive to the continuous improvement of regulations and guidelines relevant to the cruise ship industry in order to limit cruise ship impacts and ensure that the growing number of tourists do not disrupt delicate habitats, cultures and Arctic livelihoods.

6.13 Policy Response

Arctic governments continuously need to introduce prudent, timely and appropriate measures built on guiding principles[7] while still allowing for economic development, job creation and improving local livelihoods. In particular, there is a need for more integrated approaches which acknowledges the concepts of ecosystem management, natural capital, ecosystem services, life-cycle thinking or ecological footprints, as these concepts embraces many of the key components needed for a development that is sustainable and balanced (Box 6.2). These concepts are critical when it comes to constructing viable and long-term solutions that will sustain economic growth at the same time as ensuring ecosystem resilience and human development in the Arctic.

Even though many national, bilateral and international measures and instruments are currently in place when it comes to regulating activities and safeguarding the environment in the Arctic, there still exits gaps and weaknesses and, as mentioned earlier, there is a need for raising the baseline and strengthening the existing frameworks. All existing measures of regulation – in the Arctic and elsewhere – are the result of national, bilateral or international compromises of various political or sector interests, levels of ambitions or budgetary restrictions – often with the lowest common denominator as a result. The measures agreed upon are therefore often inadequate or lack the funding or long-term commitment required to effectively meet the challenges. Policy makers are often quick to point out 'low-hanging fruits' and introducing soft or voluntary measures in individual sectors rather than embarking on the large integrated strategies needed to green the economy and incorporate all the necessary considerations in order to secure a sustainable development. Unfortunately, there are also plenty of examples of "late lessons from early warnings", where warnings and recommendations from scientific research and other sources of knowledge were not followed, such as late policy action on ozone-depleting substances, acid rain, leaded petrol or the use of DDT and asbestos [9].

In general, specific environmental challenges, which often present themselves with local effects and impacts, have therefore in the past been dealt with through targeted policies and specific instruments. The new challenge for Arctic governments is how to balance the need for resources, economic growth and raising living conditions with the less visible (and perhaps less obviously immediate) need for supporting, regulating and ensuring that the services which ecosystems provide are maintained and the human-made systemic risks and vulnerabilities which threaten ecosystem security are reduced. The continued over-exploitation of natural capital cannot continue and strategies on how to counteract and phase out damaging practices and activities are crucial in the pursuit for a development that is sustainable

[7] European Union for example uses the following guiding principles: (1) the precautionary principle, (2) the prevention principle, (3) the polluter-pays principle, (4) the principle of integrating environmental considerations into other sector-measures and (5) the principle of rectifying damage at source.

Box 6.2 Key Concepts Relevant for Discussions on Sustainable Development

Natural capital is the stocks of natural resources from where goods can be derived at the same time as maintaining ecosystem services. It is essential that natural capital is managed in a sustainable manner regardless of whether it is non-renewable resources (fossil fuel/minerals), renewable but exhaustible resources (fish stocks, water, soil) or renewable and non-exhaustible resources (wind, waves). It is also essential that ecosystem structures, functions and resilience is maintained in order to ensure the ***ecosystem services*** human development depend on; such as clean air and drinking water, healthy and unpolluted food or the capacity of fish stocks to regenerate.

Integrating environmental concerns into sector policies and efforts to promote more sustainable consumption and production patterns are important when aiming to avoid habitat destruction, resource depletion, reducing pollution, ensuring healthy food and ensuring ***ecosystem resilience*** that for example prevent fish stocks from collapsing or the oceans absorption capacity for greenhouse gasses. The ecosystems' ability to maintain human wellbeing should not be underestimated.

Policy makers need to address the issues of ***resource efficiency*** and ***ecosystem accounting*** in order to decouple economic growth and waste generation from the degradation of natural capital [17]. If the true value of ecosystems is not factored into the economy, sustaining and enhancing human wellbeing across generations will be jeopardised. Ecosystem degradation therefore needs to be incorporated into market prices on commodities that often do not account for unsustainable exploration of resources, and reflected in supplements to GDP measurements.

Ecosystem-based management are coherent ways of managing the existing and expected demands for non-renewable and renewable resources and avoiding further over-exploitation of natural capital. At the moment there exist a number of different approaches and methods when it comes to ecosystem-based approach to management and there is not an agreed practice of the concept which continues to be developed. One of the key elements that are being developed as part of ecosystem-based management is the improvement of data and information tools as well as spatial planning instruments. These instruments support an ***integrated management approach*** and facilitate a better understanding of the impacts of individual sector activities and the relationship between them. It is commonly agreed that ecosystem-based management require cooperation and shared responsibility at all levels of government and sectors and ideally across borders.

Integrated Ecosystem Management plans that incorporates all economic sector activities with the environmental capacity and ecosystem resilience is to be promoted, and examples are the EU Integrated Maritime Strategy or Norway's Integrated Management Plan for the Barents Sea and sea areas off the Lofoten Islands.

and will provide continued economic growth for the region and it people. As this cannot be tackled through integrating environmental concerns in individual sector policies alone, increasing emphasis should be put on holistic approaches on strengthening ecosystem resilience, building adaptive capacity and greening the economy.

6.14 Supporting Informed Decision-Making

In order for the Arctic stakeholders to put themselves in a better position to meet the challenges and provide the needed support for ecosystems and their continued stream of services, and thereby demonstrating that sustainable development is possible, a better understanding of the Arctic and Arctic-Global systems is needed as well as better and more regular assessments of the Arctic environment, trends and outlooks.

Scientists have already warned that environmental feedback mechanisms increase the likelihood of large-scale non-linear changes in key Earth system components as tipping points are reached [13]. The recent International Polar Year have contributed to a better understanding of the Arctic processes but still more knowledge is needed when it comes to developing robust and reliable models, scenarios and integrated assessments that explain tipping points and possible state-changes and further evidence of the human impact and global drivers affecting the Arctic region.

Decision makers must have access to the best available information and more work is required to develop the needed information flows including near real-time data and regularly updated indicators in order to provide stronger evidence for early interventions and preventative actions, supporting enforcement efforts and enhancing the overall management of the Arctic's natural resources. Or in short; managing risk and reducing uncertainty. The awareness of unknown or unpredictable effects of current actions (or inactions) due to among other things large time-lags – extending sometimes into decades – further increase the call for more information, knowledge, assessments and outlooks/scenarios in order to devise the appropriate strategies. This applies to global decision-makers as well as Arctic decision-makers; Global decision-makers should more regularly be provided with comprehensive assessments of the state and outlook of the Arctic environment and the consequences of the actions and inactions. Similarly, Arctic decision-makers, particularly at the sector level, should be made aware of global trends that will affect their region, as the responsibility lies with them, when it comes to managing the economic sector activities taking place on land or in their territorial waters.

The Arctic Council has initiated a process to establish a comprehensive observation network [6] that will provide long-term monitoring of key parameters and facilitate data and information sharing between Arctic nations and other international actors. The vision is that such a network can improve the level of knowledge when it comes to key trends, drivers and describing effects of human activities as well as pointing to knowledge gas that need to be addressed. The work has to be integrated into the ongoing environmental cooperation and monitoring efforts in neighbouring regions, like the European Environment Information and Observation Network, the Arctic Observing Network in North America or the Global Environment Outlook through the

United Nations Environmental Programme, to build on existing building blocks and avoid duplication of monitoring efforts which are particularly costly in the Arctic.

Given the global importance of Arctic issues and the international nature of Arctic research, it is beneficial to the Arctic observation network process to include non-Arctic states in the pursuit of improving Arctic monitoring and research capabilities to support regulatory stability and more effective governance. Adding Community Based Monitoring and traditional knowledge is also an important aspect that will support the effect of the network.

6.15 Strengthening Governance Structures and Engaging the International Community

Arctic governments already have policies in place to address most of the harmful impacts affecting the Arctic. However as argued above, these policies need to be strengthened, streamlined and managed in a more integrated manner in order to limit human impacts and avoid undermining future economic growth. In order to support such efforts, strengthened governance structures have been highlighted as a way forward, including a closer cooperation between the Arctic nations and the international community. Not least as many of the pressures and drivers of change, like climate change, international trade patterns or long-range pollution, cannot be tackled by the Arctic nations in isolation. In addition, the Arctic states have – through the coordinated efforts in the Arctic Council – the potential to leave a greater 'Arctic fingerprint' on international regulation if promoted as an Arctic block in the negotiations.

Seeing that international cooperation efforts are essential to tackle Arctic environmental issues, it is important that this be more explicitly acknowledged by the Arctic states and that non-Arctic states are included in this endeavour. This approach by seeking regional solutions with international partners might also be more effective as opposed to trying to reach agreement through international bodies and conventions with lower or limited Arctic state influence. It also has to be recognised that although most of the Arctic basin is covered by the littoral Arctic states' national jurisdiction (there is an ongoing process under the Law of the Sea Convention to determine the outer limits of the continental shelves), there is a central part of the Arctic Ocean that will continue to be considered international waters and in which the international community will have a legitimate interest. International interest is therefore unavoidable and international solutions will be required.

Regions outside the Arctic are influenced by the Arctic, but they also have an impact on the Arctic as well. As an example, the EU has conducted an assessment of their Arctic Footprint [8], which evaluated the pressures on the Arctic environment derived from the EU. Results indicate that the EU might contribute with as much as 35 % of global contribution to the Arctic impacts. Consequently, long-term policy options for the Arctic Ocean must touch on the contribution of other countries and regions that impact the Arctic, and the aim should be to find binding policy options that address all the pressures currently affecting the Arctic.

6.16 Conclusion and Final Reflections

When considering sustainable development it is important to understand and acknowledge the Arctic populations' – indigenous or not – growing demand for economic development, improved living conditions and higher health standards. Creating job opportunities for the population and allowing for industrial activities are not necessarily incompatible with safeguarding the environment as long as appropriate measures are in place to protect the environment and to avoid accidental effects from increased exploitation of the living and non-living resources. And when doing so, it is important to respect and take into account the culture, languages and traditional practices of the indigenous peoples before starting new economic activities.

Efforts to promote sustainable development in the Arctic has since 1996 been coordinated by the Arctic Council [14], which particularly aims at facilitating and ensuring sustainable development. A number of Arctic Council declarations have reaffirmed the Council's commitment to sustainable development, and the Councils six working groups are actively engaged in addressing sustainable development considerations through: (i) assessments on keys areas of importance, like climate change, pollution or Arctic shipping, (ii) work on eco-system based management practices, (iii) conducting human development reports or (iv) conducting reviews on the gaps and weaknesses of regulations relevant to the Arctic Ocean. However, the Arctic Council has its limitations with regard to sustainable development, namely: (1) it was established as a decision shaping and not decision making body; (2) decisions are made by consensus which slows progress and could lead to the lowest common denominator; and (3) a number of important policy areas relevant to sustainable development discussions – like security or fisheries policy – are not addressed.

But the fact that all Arctic states, with international stakeholders as observers, jointly work on addressing the key considerations of sustainable development, environmental protection and including the views of indigenous peoples groups in joint efforts is a positive development. Furthermore, it leaves hope for more concerted action to help preserve and strengthen the resilience of the Arctic ecosystems through a precautionary approach when many of the regional measures needed in the Arctic will have to be agreed between eight industrialised nations – all with high level of knowledge and understanding of the complex interactions – that hopefully all will to seek sustainable solutions for the benefits of their people.

It must be underlined that peace and a stable security environment is a prerequisite for sustainable development as a hostile, tense or insecure region will see less investments, growth and development compared with stable, secure and democratic regions. Luckily, in contrast to many other areas in the world, the boundaries in the Arctic have so far been resolved peacefully. And even though strong rhetoric are sometimes used in the international press, the recent signing in 2010 of a treaty between Norway and the Russian Federation on cooperation and maritime delimitation in the Barents Sea as well as the 2008 signing of the *Ililussat Declaration* by the five Arctic coastal states have indicated that the Arctic states are committed to the pursuit of a peaceful settlement of Arctic issues. Even Canada and Denmark have ‘agreed to disagree’ when it comes to the disputed Hans Island between Greenland and Canada, and such diplomatic solutions are examples of peaceful means of settling arguments, the first hurdle to be passed in the pursuit of a sustainable development in the Arctic region. It should be noted that the work on security implications related to environmental pressures, including the Arctic region, are currently being pursued through the United Nations [18]. Work through this avenue and addressing trends and scenarios will hopefully also lead to solutions that are favourable to stability and a sustained growth, including in the Arctic.

Finally, as a further sign of optimism, it is positive that the Arctic environment is still relatively clean, despite the many economic activities taking place in the region, and there is a real possibility that the Arctic states – in cooperation with other international partners – can secure sustainable strategies in the long run. Some Arctic states are further ahead than others when addressing the core problems and implementing integrated management plans. But all Arctic governments and stakeholders need to step up their national and international efforts and focus on making the protection of biodiversity and ecosystem resilience a high priority in policymaking at all scales. Particularly when addressing energy, fisheries, forestry, regional development or transport routes in the Arctic, before further industrial developments take away this window opportunity. Because even through the Arctic region is influenced by policies and practices in other parts of the world and global integration and cooperation is needed, the concrete steps that Arctic countries will be taking – demonstrating what sustainable development means in practice – could have a major positive effect on reaching sustainability in the whole world. The Arctic has that potential!

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Chapter 7
Arctic Impact Assessment: Setting the Stage

Robert W. Corell

Abstract The Arctic Climate Impact Assessment (ACIA) report to the Arctic Council in 2004 was the "first" comprehensive assessment of climate change in the Arctic. It delivered dramatic messages to the world on the changes in the Arctic climate and the critical role of this region for the future development of the global climate. These messages were confirmed in the fourth assessment report of the Intergovernmental Panel on Climate Change (IPCC) in 2007. Hence, this chapter seeks to summarize the findings of the ACIA that are increasingly viewed as foundational security issues for a sustainable future for the Arctic region and a bellwether of change for the rest of the world. Further, there follows a discussion of the Arctic Council assessments that followed the ACIA as well as an outline of a potential comprehensive follow-on assessment that is designed to assess the many elements of change, many of which have security implications for the eight Arctic countries, the peoples of the north, and for the world at large.

7.1 Arctic Climate Impact Assessment (ACIA)

The concepts and development of international and topical scientific assessments is one of the remarkable developments of the latter decades of the twentieth century, a strategy that has transformed the role of science in our societies. As Watson et al. [27] note:

> the scientific community is coming under increasing pressure to improve humanity's understanding of key processes, to estimate the potential impacts of global environmental change, and to evaluate technologies and strategies for dealing with such issues. This is providing new opportunities for research as well as increasing the responsibilities for participation in scientific assessments designed to provide timely information for decision-making.

R.W. Corell (✉)
Global Environment and Technology Foundation, Center for Energy and Climate Solutions, 2900 S. Quincy Street, Suite 375, Arlington, VA 22206, USA
e-mail: global@dmv.com

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Many assessments of the changing climate have been undertaken during the last several decades of the twentieth century and into the twenty-first century ranging from the four assessments by the Intergovernmental Panel on Climate Change [16], Arctic Climate Impact Assessment [1, 2] and the Millennium Ecosystem Assessment [17] as well as other international scientific assessments. There also have been numerous national scientific assessments, such as through the United States Global Change Research Program [25], as well as other assessments of climate change at regional and local scales [14,18]. Studies have concluded that for assessments to be effective and address the needs and facilitate action by the relevant audiences and institutions [12], the assessment must address and be guided by these three criteria:

1. <u>Relevance</u>: The assessment must address issues of importance and relevance to the organizations, audiences, and institutions to which it seeks to serve and to provide insights and objective information for decision-maker and other action.
2. <u>Credence</u>: The design, implementation and qualifications of those conducting the assessment must have unassailable expertise, and the information contained in the assessment must be credible, authoritative, and be based on peer or otherwise objectively reviewed materials and information sources, and
3. <u>Authoritative</u>: The assessment must be given the authority to conduct the assessment by governments or other entities that can commission and sanction, in appropriate ways, the assessment.

At last count, there are over 200 international environmental treaties already in force many of which have profound security implications, covering subjects ranging from natural resource developments to climate change. Many of these require periodic reviews of the state of the relevant science, knowledge and understanding in order to amend systematically need augmentations or insights gained from changing implementation experience, social goals, and research findings. It is in this context that to understand and obtain insights about the dimensions of environmental security in the Arctic there is a need to facilitate pathways toward sustainable development and environmental protection.

Prime Minister Vladimir Putin [21] spoke about *"our common Arctic home"* and the need for balanced, well-conceived solutions *with "genuine partnership in the economy, security, science, education and the preservation of the North's cultural heritage."* He stated, *"preserving the Arctic as a zone of peace and cooperation is of the utmost importance,"* recognizing that *"Arctic nature itself makes individuals, groups of people and entire countries dependent on each other."*

The ACIA [1] was a comprehensively researched, fully referenced, and independently reviewed evaluation of Arctic climate change and its impacts for the region and for the world.

> The Arctic is now experiencing some of the most rapid and severe climate change on Earth. Over the next 100 years, climate change is expected to accelerate, contributing to major physical, ecological, social, and economic changes, many of which have already begun. Changes in Arctic climate will also affect the rest of the world through increased global warming and rising sea levels.

Box 7.1 Chapters of the Arctic Climate Impact Assessment [2]

1. An Introduction to the Arctic Climate Impact Assessment (ACIA);
2. Arctic Climate – Past and Present;
3. The Changing Arctic: Indigenous Perspectives;
4. Future Climate Change: Modeling and Scenarios for the Arctic;
5. Ozone and Ultraviolet Radiation;
6. Cryosphere and Hydrology;
7. Arctic Tundra and Polar Desert Ecosystems;
8. Freshwater Ecosystems and Fisheries;
9. Marine Systems;
10. Principles of Conserving the Arctic's Biodiversity;
11. Management and Conservation of Wildlife in a Changing Arctic Environment;
12. Hunting, Herding, Fishing, and Gathering: Indigenous Peoples and Renewable Resource Use in the Arctic;
13. Fisheries and Aquaculture;
14. Forests, Land Management, and Agriculture;
15. Human Health;
16. Infrastructure: Buildings, Support Systems, and Industrial Facilities;
17. Climate Change in the Context of Multiple Stressors and Resilience;
18. Summary and Synthesis of the ACIA.

The foundational science of ACIA [2] is contained in a 1,200-page scientific report is organized around 18 chapters that address a broad range of issues concerning climate and ultraviolet radiation changes across the circumpolar Arctic (Box 7.1).

The image in Fig. 7.1 on the left and the global atmospheric temperature data from which it is drawn, show substantial warming across the Arctic region over the last 100 years or so. An acceleration of these climatic trends is projected to occur during this century as shown on the right, due primarily to ongoing increases in concentrations of greenhouse gases in the earth's atmosphere. While greenhouse gas emissions do not primarily originate in the Arctic, they are projected to bring wide-ranging changes and impacts to the Arctic. These Arctic changes will, in turn, impact the planet as a whole. For this reason, people outside the Arctic have a great stake in what is happening there.

For example, climatic processes unique to the Arctic have significant effects on global and regional climate. The Arctic also provides important natural resources to the rest of the world (such as oil, gas, and fish) that will be affected by climate change. And melting of Arctic glaciers is one of the factors contributing to sea-level rise around the globe (Fig. 7.2).

Climate change is also projected to result in major impacts inside the Arctic, some of which are already underway. Whether a particular impact is perceived as negative or positive often depends on one's interests. For example, the reduction in sea ice is very likely to have devastating consequences for polar bears, ice-dependent seals, and local people for whom these animals are a primary food source.

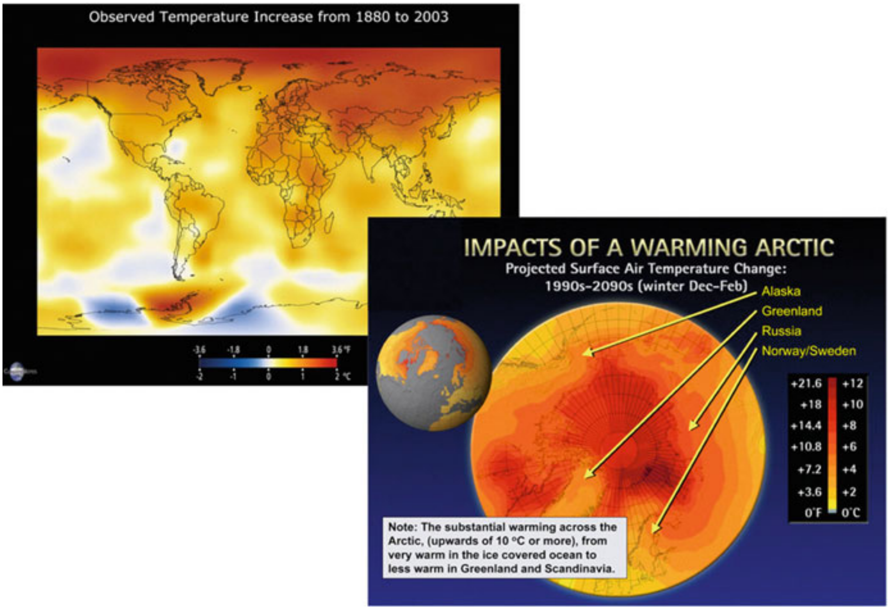
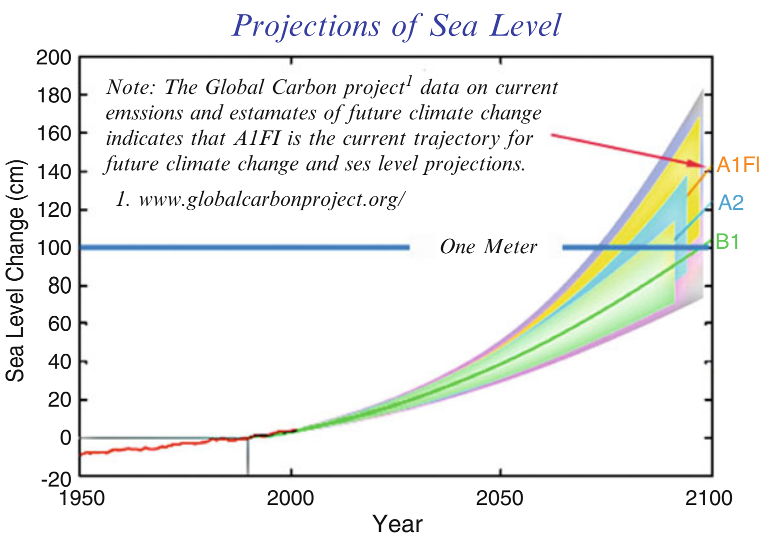


Fig. 7.1 (*Left*) Image from the National Aeronautical and Space Administration, showing the temperature differences across the Earth from 1880 to 2003. (*Right*) Projected winter surface air temperature changes in the Arctic from the 1990s to 2090s as shown in ACIA [1]



Source: PNAS 2009 Global sea level linked to global temperature.
By Martin Vermeera and Stefan Rahmstorf
Available at: www.pnas.org/content/106/51/21527

Fig. 7.2 Global sea-level rise predictions based on different global warming trajectories associated with greenhouse gas emissions. From Vermeer and Rahmstorf [26]

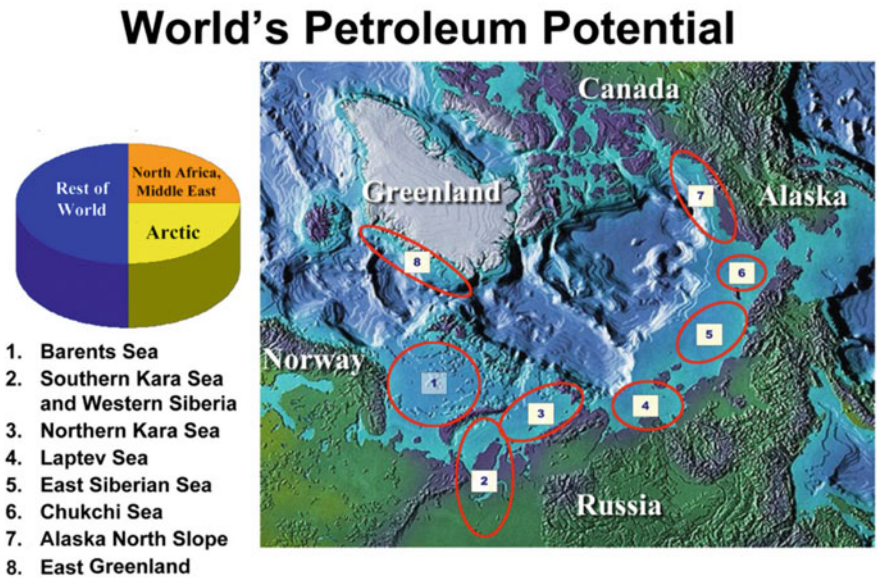


Fig. 7.3 Regions in the Arctic Ocean that are thought to have significant petroleum deposits, potentially 30% of the world's undiscovered gas and 13% of the world's undiscovered oil [15]

On the other hand, reduced sea ice is likely to increase marine access to the region's resources, expanding opportunities for shipping and possibly for offshore oil extraction (although operations could be hampered initially by increasing movement of ice in some areas). Further complicating the issue, possible increases in environmental damage that often accompanies shipping and resource extraction (Figs. 7.3 and 7.4) could harm the marine habitat and negatively affect the health and traditional lifestyles of indigenous people.

To communicate the results of this assessment, a more non-technical and plain language *Overview Report* [1] was prepared that integrates the scientific aspects of the assessment through ten Key Findings (Table 7.1), the essence of which are:

1. Arctic climate is now warming rapidly and much larger changes are projected;
2. Arctic warming and its consequences have worldwide implications;
3. Arctic vegetation zones are very likely to shift, causing wide-ranging impacts;
4. Animal species' diversity, ranges, and distribution will change;
5. Many coastal communities and facilities face increasing exposure to storms;
6. Reduced sea ice is very likely to increase marine transport and access to resources;
7. Thawing ground will disrupt transportation, buildings, and other infrastructure;
8. Indigenous communities are facing major economic and cultural impacts;
9. Elevated ultraviolet radiation levels will affect people, plants, and animals;
10. Multiple influences interact to cause impacts to people and ecosystems.

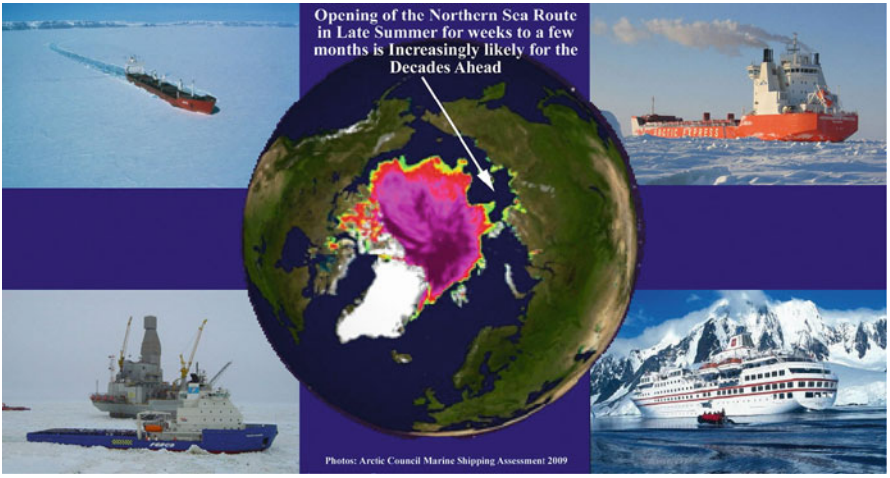


Fig. 7.4 Opening of the Northern Sea route along the Russian coast with summer open water from the Bering Strait to the Barents Sea. Images from the *Arctic Marine Shipping Assessment* [20]

Table 7.1 Key findings of the Arctic Climate Impact Assessment [1,2]

1. **Arctic climate is now warming rapidly and much larger changes are projected.**
   - Annual average arctic temperature has increased at almost twice the rate as that of the rest of the world over the past few decades, with some variations across the region.
   - Additional evidence of arctic warming comes from widespread melting of glaciers and sea ice, and a shortening of the snow season.
   - Increasing global concentrations of carbon dioxide and other greenhouse gases due to human activities, primarily fossil fuel burning, are projected to contribute to additional arctic warming of about 4–7 °C over the next 100 years.
   - Increasing precipitation, shorter and warmer winters, and substantial decreases in snow cover and ice cover are among the projected changes that are very likely to persist for centuries.

   Unexpected and even larger shifts and fluctuations in climate are also possible.
2. **Arctic warming and its consequences have worldwide implications.**
   - Melting of highly reflective arctic snow and ice reveals darker land and ocean surfaces, increasing absorption of the sun's heat and further warming the planet.
   - Increases in glacial melt and river runoff add more freshwater to the ocean, raising global sea level and possibly slowing the ocean circulation that brings heat from the tropics to the poles, affecting global and regional climate.
   - Warming is very likely to alter the release and uptake of greenhouse gases from soils, vegetation, and coastal oceans.
   - Impacts of arctic climate change will have implications for biodiversity around the world because migratory species depend on breeding and feeding grounds in the Arctic.
3. **Arctic vegetation zones are very likely to shift, causing wide-ranging impacts.**
   - Treeline is expected to move northward and to higher elevations, with forests replacing a significant fraction of existing tundra, and tundra vegetation moving into polar deserts.
   - More-productive vegetation is likely to increase carbon uptake, although reduced reflectivity of the land surface is likely to outweigh this, causing further warming.

(continued)

Table 7.1 (continued)

- Disturbances such as insect outbreaks and forest fires are very likely to increase in frequency, severity, and duration, facilitating invasions by non-native species.
- Where suitable soils are present, agriculture will have the potential to expand northward due to a longer and warmer growing season.

4. Animal species' diversity, ranges, and distribution will change.

- Reductions in sea ice will drastically shrink marine habitat for polar bears, ice-inhabiting seals, and some seabirds, pushing some species toward extinction.
- Caribou/reindeer and other land animals are likely to be increasingly stressed as climate change alters their access to food sources, breeding grounds, and historic migration routes.
- Species ranges are projected to shift northward on both land and sea, bringing new species into the Arctic while severely limiting some species currently present.
- As new species move in, animal diseases that can be transmitted to humans, such as West Nile virus, are likely to pose increasing health risks.
- Some arctic marine fisheries, which are of global importance as well as providing major contributions to the region's economy, are likely to become more productive. Northern freshwater fisheries that are mainstays of local diets are likely to suffer.

5. Many coastal communities and facilities face increasing exposure to storms.

- Severe coastal erosion will be a growing problem as rising sea level and a reduction in sea ice allow higher waves and storm surges to reach the shore.
- Along some arctic coastlines, thawing permafrost weakens coastal lands, adding to their vulnerability.
- The risk of flooding in coastal wetlands is projected to increase, with impacts on society and natural ecosystems.
- In some cases, communities and industrial facilities in coastal zones are already threatened or being forced to relocate, while others face increasing risks and costs.

6. Reduced sea ice is very likely to increase marine transport and access to resources.

- The continuing reduction of sea ice is very likely to lengthen the navigation season and increase marine access to the Arctic's natural resources.
- Seasonal opening of the Northern Sea Route is likely to make trans-arctic shipping during summer feasible within several decades. Increasing ice movement in some channels of the Northwest Passage could initially make shipping more difficult.
- Reduced sea ice is likely to allow increased offshore extraction of oil and gas, although increasing ice movement could hinder some operations.
- Sovereignty, security, and safety issues, as well as social, cultural, and environmental concerns are likely to arise as marine access increases.

7. Thawing ground will disrupt transportation, buildings, and other infrastructure.

- Transportation and industry on land, including oil and gas extraction and forestry, will increasingly be disrupted by the shortening of the periods during which ice roads and tundra are frozen sufficiently to permit travel.
- As frozen ground thaws, many existing buildings, roads, pipelines, airports, and industrial facilities are likely to be destabilized, requiring substantial rebuilding, maintenance, and investment.
- Future development will require new design elements to account for ongoing warming that will add to construction and maintenance costs.
- Permafrost degradation will also impact natural ecosystems through collapsing of the ground surface, draining of lakes, wetland development, and toppling of trees in susceptible areas.

8. Indigenous communities are facing major economic and cultural impacts.

- Many Indigenous Peoples depend on hunting polar bear, walrus, seals, and caribou, herding reindeer, fishing, and gathering, not only for food and to support the local economy, but also as the basis for cultural and social identity.

(continued)

Table 7.1 (continued)

- Changes in species' ranges and availability, access to these species, a perceived reduction in weather predictability, and travel safety in changing ice and weather conditions present serious challenges to human health and food security, and possibly even the survival of some cultures.
- Indigenous knowledge and observations provide an important source of information about climate change. This knowledge, consistent with complementary information from scientific research, indicates that substantial changes have already occurred.

9. Elevated ultraviolet radiation levels will affect people, plants, and animals.

- The stratospheric ozone layer over the Arctic is not expected to improve significantly for at least a few decades, largely due to the effect of greenhouse gases on stratospheric temperatures. Ultraviolet radiation (UV) in the Arctic is thus projected to remain elevated in the coming decades.
- As a result, the current generation of arctic young people is likely to receive a lifetime dose of UV that is about 30 % higher than any prior generation. Increased UV is known to cause skin cancer, cataracts, and immune system disorders in humans.
- Elevated UV can disrupt photosynthesis in plants and have detrimental effects on the early life stages of fish and amphibians.
- Risks to some arctic ecosystems are likely as the largest increases in UV occur in spring, when sensitive species are most vulnerable, and warming-related declines in snow and ice cover increase exposure for living things normally protected by such cover.

10. Multiple influences interact to cause impacts to people and ecosystems.

- Changes in climate are occurring in the context of many other stresses including chemical pollution, overfishing, land use changes, habitat fragmentation, human population increases, and cultural and economic changes.
- These multiple stresses can combine to amplify impacts on human and ecosystem health and well-being. In many cases, the total impact is greater than the sum of its parts, such as the combined impacts of contaminants, excess ultraviolet radiation, and climatic warming.
- Unique circumstances in arctic sub-regions determine which are the most important stresses and how they interact.

source: www.acia.uaf.edu/pages/overview.html

These summary findings have profound implications not only for the Arctic region, but also for the world at large. Security issues are nested – not seen with adequate clarify yet – in ways that have implications for human well-being, national sovereignty, governance issues at national and regional levels and for resource development strategies (Fig. 7.5).

7.2 Beyond ACIA

The challenges and attendant opportunities from climate and globalization changes have profound implications for humankind. As former Secretary General of the United Nations, Kofi Annan [11], stated:

> The stakes are high indeed. Climate change has profound implications for virtually all aspects of human well-being, from jobs and health to food security and peace within and among nations. Yet too often, climate change is seen as an environmental problem when it should be part of the broader development and economic agenda. Until we acknowledge the all-encompassing nature of the threat, our response will fall short.

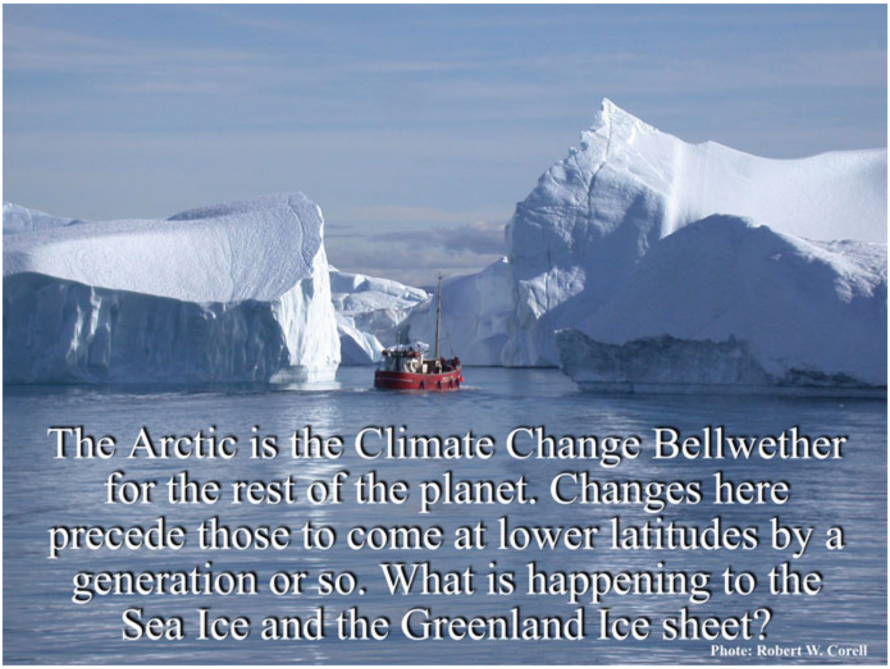


Fig. 7.5 Arctic bellwether of climate warming on Earth (Photo from author)

The Arctic has been exposed to many of these changes, some occurring with accelerating impacts. These include, inter alia:

- Substantial changes in climate and weather;
- Rapid cultural and social change;
- Globalization such as mixed economies and technological changes;
- High concentrations of contaminants such as PCBs (polychlorinated biphenyls) and mercury; and
- Ozone depletion that leads to UV (ultraviolet) radiation increases.

The scientific community began to report changes across the Arctic region, such as those listed above, which were summarized in briefings to the Arctic Council in the late 1990s. The Arctic Council, established by the *Ottawa Declaration* [19], is a high level intergovernmental forum[1] to.

[1] Member States of the Arctic Council are Canada, Denmark (including Greenland and the Faroe Islands), Finland, Iceland, Norway, Russian Federation, Sweden, and the United States of America as well as the Permanent Participants of the Arctic Council representing the six Indigenous Peoples Organizations of the Arctic: Aleut International Association (AIA), Arctic Athabaskan Council (AAC), Gwich'in Council International (GCI), Inuit Circumpolar Council (ICC), Saami Council, and the Russian Arctic Indigenous Peoples of the North (RAIPON).

> provide a means for promoting cooperation, coordination and interaction among the Arctic States, with the involvement of the Arctic indigenous communities and other Arctic inhabitants on common arctic issues*, in particular issues of sustainable development and environmental protection in the Arctic.

One of the early comprehensive assessments that the Arctic Council authorized in 2000 was the ACIA. Since the release of the ACIA in 2004, there have been a number of follow on topical assessments authorized by the Arctic Council, including:

- *Heavy Metals in the Arctic* [3];
- *Human Health in the Arctic* [4];
- *Acidifying Pollutants, Arctic Haze, and Acidification in the Arctic* [5];
- *Arctic Oil and Gas 2007* [6];
- *Arctic Human Development Report* [23];
- *Arctic Marine Shipping Assessment* [20];
- *Radioactivity in the Arctic* [7];
- *Persistent Organic Pollutants in the Arctic* [8];
- Mercury Assessment Report [10].

Building on ACIA [1,2] – the *Snow, Water, Ice and Permafrost in the Arctic* assessment [9] further reinforced that:

> The Arctic is warming. Surface air temperatures in the Arctic since 2005 have been higher than for any five-year period since measurements began around 1880. The increase in annual average temperature since 1980 has been twice as high over the Arctic as it has been over the rest of the world. Evidence from lake sediments, tree rings and ice cores indicates that Arctic summer temperatures have been higher in the past few decades than at any time in the past 2000 years. Previously unseen weather patterns and ocean currents have been observed, including higher inflows of warm water entering the Arctic Ocean from the Pacific. These changes are the main drivers of change in the Arctic cryosphere.

7.3 Arctic Change Assessment (ACA)

It is increasingly clear that the Arctic will continue to be impacted and will respond often earlier than the other regions of the planet to the rapid changes induced by climate and globalization. Many of the changes have security implications, as seen from this listing of governance issues that are likely to appear from the rapidly changing conditions across the Arctic region:

- <u>Issues of Access and Rights of Passage Through Sea Routes:</u> These issues will be critical to not only the coastal nations of the Arctic, but to natural resource development, trade and commercial sea routes for many other nations;
- <u>Maritime Claims and Boundary Issues:</u> As the Arctic ocean sea ice continues to diminish, numerous issues are likely to be raised involving claims to jurisdiction over areas beyond the territorial sea within the Arctic oceanic basin;
- <u>Commercial Shipping and Oil and Gas Development:</u> Issues regarding the development of effective codes of conduct for shipping under Arctic conditions and for the conduct of offshore oil and gas drilling and production;

- Arctic Fisheries: Management of northward moving commercial fisheries that takes into account the principles of ecosystem-based management and the rights of indigenous peoples;
- Land Claims: Longstanding use and occupancy and the still unresolved claims of a number of indigenous peoples as they relate to the governance of human-environment interactions in the Arctic;
- Conservation of Arctic Ecosystems: Protection of marine and terrestrial ecosystems in the Arctic under pressure from human actions as well as biophysical changes; and
- Regional Governance: Multi-level governance and collaboration among regional, national, and international bodies in guiding northern development toward mutually desirable ends.

With this landscape of issues – Arctic Council working groups along with the International Arctic Sciences Committee, International Arctic Social Sciences Association and potentially other collaborating organizations are exploring implementation of a comprehensive assessment of the many inexorably interconnected changes that the Arctic region is experiencing. An ad hoc committee has been established under the Arctic Monitoring and Assessment Programme (AMAP) of the Arctic Council to design and scope the range of issues to address with a proposal to the Arctic Council in May 2011. The working title for this proposed international, interdisciplinary and inclusive assessment is the *Arctic Change Assessment* (ACA).

ACA is planned as a 6-year project to be finalized by 2017. Further, the Arctic Council endorsed the initiation of an *Arctic Resilience Assessment* [24], the goal of which is to help prepare decision makers for managing Arctic social-ecological systems in a period of rapid change with large uncertainties. To initiate both of the new assessments, scoping workshops were scheduled for September 2011. An initial listing of issues to be addressed by the ACA include:

- Impacts of uses of Arctic resources;
- Understanding the Arctic Ocean;
- Arctic Ocean acidification;
- Human adaptations to Arctic change;
- Indigenous peoples perspectives of Arctic change and adaption;
- Human Dimensions of Change;
- Human adaptation strategies and socio-economic impacts;
- Arctic and the global hydrological cycle;
- Downscaling climate models for predictions and forwarding-looking scenarios in the Arctic;
- Levels, predictions and impacts of methane release in the Arctic;
- Understanding short-lived climate forcers;
- Update the *Snow, Water, Ice and Permafrost in the Arctic* (SWIPA) study;
- Address food security and safety;
- Impacts of climate change on contaminant pathways; and
- Changes in fisheries and fisheries management strategies.

7.4 Conclusions

As noted in the annual *Arctic Report Card* in 2010 [22], it is clear that the Arctic is experiencing the impacts of a prolonged and amplified warming trend, highlighted with many record-setting events. Not surprisingly, the impact of this warming is most evident in the dramatic losses that have been observed in the ice covers that define the region. Since the loss of these ice covers serves to further feed the warming trend, the expectation is that warming will continue. Further the *Arctic Report Card 2010* concludes that there were continued widespread and, in some cases, dramatic effects of a warming in the Arctic, where deviations from the average air temperature are amplified by a factor of two or more in the Arctic relative to lower latitudes and global means. Further, the security issues are being reported by studies such as the one conducted by the CNA Corporation [13] with retired flag officers of the United States military, who concluded, inter alia, that:

- Global climate change presents a new and very different type of national security challenge;
- Projected climate change will add to tensions even in stable regions of the world;
- Projected climate change poses a serious threat to the United States national security;
- The increasing risks from climate change should be addressed now because they will almost certainly get worse if we delay.

What is now increasingly clear is that climate change is underway and that globalization across the planet very likely will together have profound impacts and consequences for humankind and the environmental biosphere that supports all forms of life. Assessment like the ACIA and the others that followed have begun to frame the science and knowledge foundations decision-making, policy formulation, and in the long run action to mitigate the impacts from a changing Arctic. Scoping of the *Arctic Change Assessment* (ACA), authorized by the Arctic Council in May 2011, should provide new scientific knowledge and insights that can extend and deepen the necessary foundations for effective decision-making, policy development and action in the Arctic region.

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Part III
Geopolitics of the Arctic Ocean

Chapter 8
Impacts on Indigenous Peoples from Ecosystem Changes in the Arctic Ocean

Patricia A.L. Cochran

Abstract Indigenous peoples from all regions of the world depend upon the natural environment. Their rich and detailed traditional knowledge reflects and embodies a cultural and spiritual relationship with the land, ocean and wildlife. Human activity is changing the world's climate and altering the natural environment to which Indigenous Peoples are so closely attached and on which they so heavily rely.

The Intergovernmental Panel on Climate Change (IPCC) projects an acceleration and deepening of the impacts and effects of climate change globally with potentially serious implications for the cultures, subsistence economies, health and futures of Indigenous Peoples. Climate change is particularly marked in high latitudes. The *2004 Arctic Climate Impact Assessment* (ACIA) prepared by the eight-nation Arctic Council with the assistance of six Arctic Indigenous Peoples Organizations projected severe and growing impacts in this region in coming decades with worldwide effects.

In a very real sense, Indigenous Peoples are on the front lines of climate change. They observe climate and environmental changes first-hand and use traditional knowledge and survival skills to adapt to these changes as they occur. Moreover, they do so at a time when their cultures and livelihoods are already undergoing significant changes due, in part, to the accelerated development of natural resources from their traditional territories.

Reflecting their position as "stewards" of the environment and drawing upon age-old traditional knowledge, Indigenous Peoples were among the first to call upon national governments, corporations and civil society to do more to protect the Earth and human society from climate change.

P.A.L. Cochran (✉)
Alaska Native Science Commission, 429 L Street, P.O. Box 244305,
Anchorage, AK 99524, USA
e-mail: pcochran@aknsc.org

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8.1 Perspectives

It was only a few years ago, after the release of the *Arctic Climate Impact Assessment* [1], that climate change in the Arctic began coming into the global consciousness. ACIA's long-term projections for the North included an ice-free Arctic Ocean by the summer of 2050, and the loss of our hunting and sharing culture due to climate change. While those forecasts seemed dire then, I only wish that they had been true.

We are now in the midst of a historic transformation in the Arctic. In the past several years, we have witnessed entire landscapes and icescapes on the move or disappearing. In 2006, the projections for an ice-free Arctic summer were revised down, to 2040. And after the recent tremendous melts stunned scientists around the world, the most alarming estimates show a new, open seasonal sea at the top of our world within a decade. There is now a real sense of urgency.

Let me share with you some of what Inuit, as indigenous peoples, have learned from these great changes – not only what our communities have observed in our changing landscape but more importantly, the wisdom our people, and all indigenous peoples, have gained as we adapted over millennia to survive and thrive in diverse environments around the Earth, and as we now struggle to adapt to the new challenges of climate change.

For decades, we in the Arctic have witnessed the most dramatic environmental effects of globalization. We have weathered the onslaught of persistent organic pollutants, heavy metals and other contaminants, borne north in the winds and ocean currents. At the same time, chlorofluorocarbons and other chemicals were weakening our world's ozone particularly in high latitudes, leaving us to face intense ultraviolet radiation. But even as Protocols have begun to mend our ozone, and the *Stockholm Convention on Persistent Organic Pollutants*, which Arctic indigenous peoples fought so hard for, has started to decrease the levels of contaminants in our environment, we face a new set of changes which will be even more difficult to reverse.

In the Arctic, our indigenous communities are struggling to cope with extreme erosion, melting permafrost and slumping beaches, thinning sea ice, receding glaciers, and an "invasion" of new species of animals. Inuit are not alone in experiencing these changes; peoples across the Arctic are feeling the impacts on their livelihoods, and the social fabric of their communities. The Saami in Scandinavia and Russia are struggling to maintain their traditional reindeer herding practices as shifting seasons and conditions make travelling and pasturing more difficult. In Alaska and Russia, large predators like polar bears and wolves are stressed for food as their animals that make up their traditional diets have shifted range. This means more frequent and intense contacts with these dangerous animals and adds unneeded stress and fear to the local social dynamics.

Moreover, many of these physical impacts are directly connected with those further South, and are often particularly threatening to other indigenous peoples around the world. The Greenland Ice Cap, which is melting at an unprecedented rate, holds enough water to add over 21 ft to global sea-level rise. That water is already sinking small islands countries and low-lying states. People on the coasts are threatened as are others much higher up. The Altiplano of Ecuador, Peru and Bolivia is home to large numbers of indigenous peoples who could be devastated by the loss of water from their own rapidly melting Andean glaciers. Disease patterns are shifting as well, bringing malaria, dengue fever, and possibly avian flu to areas and people who often have little access to basic health services.

In this age of globalization and our ever-increasing connectivity, we must recognize how the global affects the local, and the local affects the global. Let us consider not only the physical, but the social impacts of climate change so we can begin to imagine the endless ways our warming world will affect indigenous communities and indeed, all communities, around the globe.

The governing council of the United Nations Environment Program effectively characterizes the Arctic and sub-Arctic as barometer regions of global climate change. Inuit, Saami, Gwich'in, Aleut, Athabaskans and many other northern Indigenous peoples would add that they are the mercury in the barometer. Similarly, Indigenous peoples in temperate, tropical and equatorial regions report ecological changes, particularly to freshwater regimes, and to the distribution and abundance of terrestrial, marine and aquatic wildlife, all connected to and resulting from global climate change. There is, then, a significant opportunity, some might say obligation, to mobilize and apply the experience, knowledge and "wisdom" of Indigenous peoples in the global climate change debate.

Arctic Indigenous peoples are a perhaps uniquely adaptable people. We weathered the storm of modernization remarkably well, going from dog-teams and igloos to snowmobiles, jumbo jets, permanent homes, and even supermarket stores, all within a few decades. These enormous changes to our communities were not without consequences. Substance abuse, health problems, and, most distressing, the loss of so many of our people, especially young men, to suicide, have been among the saddest results. But through all of this, we have had our land, our predictable environment and climate, and the wisdom that our Hunters and Elders have gained from it over millennia, to help us adapt (Fig. 8.1).

Hunting is integral to our social fabric. We remain a people of the land, ice, and snow. Hunting is not just about killing animals. The process of the hunt and eating of our traditional food personifies what it means to be Inuit. It is on the land that values and age-old knowledge are passed down from generation to generation. The hunt teaches our young to be patient, courageous, bold under pressure, and reflective. They learn to control their impulses, to withstand stress, to have sound judgment and ultimately the wisdom to carry out a plan and achieve a goal. Let me repeat – our hunting culture is tied to the land. For us, climate change is an enormous *social issue*, and, thus, we believe, an issue of our right and ability to exist as an Indigenous people.

This is one of the reasons I hosted the *"Indigenous Peoples Global Summit on Climate Change*" which took place in Anchorage in April 2009. The Summit brought together more than 400 indigenous peoples from across the globe to share their stories, wisdom and strategies on climate change. The summit declaration that was adopted, the *Anchorage Declaration* [2], has set the roadmap for indigenous communities to lead the way in climate change. The *Indigenous Peoples Global*

Fig. 8.1 Arctic indigenous peoples, balancing the wisdom of the elders with the needs of the youth in view of their rich cultural heritage and future filled with change

Network on Climate Change and Sustainable Development was formed following the Anchorage Summit to continue the work plan. The Anchorage Declaration promotes coming together of not only Indigenous people worldwide, but we hope, of nations worldwide.

As that change begins, new policies must put the indigenous and other vulnerable regions of the world on a path away from perpetual reaction to environmental crisis and towards sustainable human development. The record from the Stockholm Convention and other settings shows that indigenous wisdom has its place and strength in guiding and influencing a world that has largely lost its perspective on balanced human development and sustainability.

8.2 Conclusion

We should look again to that wisdom to guide us through this great crisis, and to steer us towards a new, human-centered sustainability. As our various governments, international organizations, and development programs seek to help indigenous peoples respond and adapt to climate change, we must work to genuinely empower

Indigenous and other marginalized communities. In this great struggle with climate change we must find solutions that end the cycle of victimhood for Indigenous and other vulnerable peoples of the world. The healthy and productive spirit of "people" is the basis for all successful human development. Every level in every system, whether institution or government, must be directed to ensuring that thriving human communities form the basis for a future of hope and long term sustainability. This change will require organizations to think deeply on all facets of their programs and operations. They will have to design new types of human and community development arrangements, drawing on the best the world has to offer and at all times including and respecting the voices of those who are struggling to maintain their way of life and livelihoods.

Climate change profoundly challenges our simple-minded notion that unrestrained economic growth can cure social ills, and lead the way to a better world. There is precious little time for us to re-center development on humanity, not only industry, before we fundamentally change our world, particularly for indigenous peoples and others who contribute least to the problem but have the most to lose. Let us all work together to come to common ground in dealing with this daunting task and move forward as a human community.

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Chapter 9
United States Policy in the Arctic*

Raymond V. Arnaudo

Abstract The Arctic policy of the United States has remained broadly constant over the years since the early 1970s, when initial efforts to craft a unified U.S. government inter-agency approach to the Arctic were reviewed. It has been based on several key principles, which include the protection of our national security interests and the preservation of the principle of freedom of the seas and superjacent airspace, as well as the development and implementation of programs and activities to facilitate international cooperation in the areas of exploration, scientific research, resource development, exchange of scientific and technical data and the engagement of indigenous and local communities. The past two decades have witnessed an evolutionary trend and growth in United States perspective to welcome greater structured international and multilateral cooperation, which has resulted in more cohesion and better communication among Arctic countries.

9.1 History

It is important to remember that pan-Arctic cooperation is a relatively recent innovation. Prior to the collapse of the Soviet Union, international cooperation was limited to scientific efforts, such as the Comité Arctique, or logistical support for exploration or business projects, such as treks across the ice, or natural resources management and conservation, such as the *North Pacific Fur Seal Convention* [12] or the *Polar Bear Agreement* [14], or territorial matters, such as those raised in the *Spitsbergen Treaty* [16]. While there have always been these types of cooperative

*The views expressed in this article are those of the author and do not necessarily reflect those of the United States Department of State or the United States Government.

R.V. Arnaudo (✉)
Office of the Secretary, Department of State,Washington, DC, 20520, USA
e-mail: arnaudorv@state.gov

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arrangements, there were overriding reasons for a lack of initiatives to broaden cooperation: the Cold War and the limits of regional influence on political decisions of the major Arctic powers.

The political tensions between East and West would continue to hinder most substantive dialogues about multilateral cooperation. With the Soviet Union on one side of the equation, and the United States, Canada and Nordic countries on the other, many efforts to stretch hands across this divide were stunted, although some government agencies did work together on specific problems, mostly bilaterally. The presence of the military factor, such as the distant early warning system, or distant early warning (DEW) line, and military presence in the Arctic regions, reinforced this barrier to multilateral discussions to address common problems.

The regionalism of political interests also limited countries' willingness to seek engagement or vehicles for multilateral cooperation. In the specific case of the United States, it is an Arctic power because of Alaska, but federal decisions about international cooperation originated in Washington, and similarly, those of the Canadian Northern Territories and Russian Siberia were largely made in Ottawa and Moscow, respectively. Those living in the North of most of the Arctic countries had limited access to, not to mention control of, pan-Arctic cooperation. In the United States, for example, only 2 of 100 senators and 1 representative among 435 in the House of Representatives represent the vast expanse of the country that is Alaska. While several large, under-populated states have this similar "minimal" representation, Alaska, isolated regionally and by its far north location, speaks alone for Arctic interests. In this regard, it is important to remember than the United States does not have a parliamentary form of government: major federal programs or decisions affecting the Arctic must be approved by Congress, often not an easy process with such a small congressional representation.

With no significant federal focus on the Arctic, and congressional membership restricted to three, pressure for international outreach in the Arctic was limited. The federal government did have two interagency organizing structures which coordinated Arctic policy and Arctic scientific efforts: the Arctic Policy Group, under the National Security Council structure, chaired by the State Department, and the Interagency Arctic Research Policy Committee, authorized by the *Arctic Research and Policy Act* [5], chaired by the National Science Foundation. But funding for initiatives and programs was broadly *ad hoc* as no single federal department or agency had control of or a dedicated budget for Arctic funding.

The specific problems of the indigenous peoples living on the land presented another set of limits. As with its federal governance approach, the relevant US federal agency, the Bureau of Indian Affairs, tended to focus on indigenous peoples in the Lower 48, and not those in Alaska. And internationally, prior to the formation of the Inuit Circumpolar Conference in 1977, there was little structured coordination among native populations. The problems of Cold War tensions and lack of appropriately proportionate political influence by those living in the northern regions thus limited discussions of formalizing political cooperation in the Arctic. Add to this the simple fact that the populations affected are relatively small in Arctic countries, and it is clear that the barriers to political cooperation in the North were large.

Several forcing events took place to heighten awareness of the need for greater cooperation, which would create a better atmosphere for Arctic cooperation. First and foremost was the growth in the public's consciousness of the importance of environmental protection and global responses to problems. Public concerns about the effects of transboundary air pollution led to the adoption of the *Convention on Long-range Transboundary Air Pollution* [6] under the United Nations Economic Commission for Europe in the late 1970s. Nevertheless, there continued to be concerns with specific effects of transboundary air pollution in the Arctic. The pace of multilateral environmental negotiations would speed up in the 1980s, leading to agreements in Antarctic protections, wildlife conservation regimes, climate discussions and a global emphasis on the need for more protections. These efforts would culminate in the Rio Earth Summit of 1992, raising awareness of the importance of a regional focus on ecosystems, such as the Arctic.

Second, the scientific community began discussions by drawing Arctic and non-Arctic countries together to form the International Arctic Science Committee, which was the first pan-Arctic scientific body to be established. There were some efforts by some countries to restrict membership solely to Arctic countries, but this was resisted, in keeping with the normal arrangements of scientific bodies.

Third, in his 1987 Murmansk speech, Soviet Party Secretary Gorbachev [7] called for greater cooperation and peaceful activities, especially in the areas of resource development, scientific research, environmental protection and the rights of native groups. This remarkable mention, albeit buried in a long speech, confirmed for many of those engaged in the process of strengthening Arctic cooperation, that the Soviets were finally recognizing the need for a reach out to the West.

Lastly, a group of academics started an informal consultative group in the late 1980s, the Working Group on Arctic Relations, which brought together several of those government officials, including some from the Soviet Union, who would eventually work on the formation of the Arctic Council in an informal setting, where options and solutions could be explored. These discussions would led the Russians to explore ideas that were formally acknowledged in Gorbachev's now-famous Murmansk speech, which indicated to the other Arctic countries that the Soviet Union was interested in greater cooperation [19].

The Finns floated their call at Rovaniemi for greater Arctic cooperation in the late 1980s, which would later turn into the cooperative arrangements leading to the Arctic Council. There was no consensus for a binding convention, but the mood for a regional agreement had coalesced, and the result was the first step, the *Arctic Environmental Protection Strategy* [4], adopted in Rovaniemi, which 5 years later, would be broadened to become the Arctic Council [13].

9.2 United States Arctic Policy

America's geopolitical interests have remained broadly constant over the years. The *National Security Decision Memorandum* [10] states that it will be the Arctic policy of the United States to *"insure that Arctic development is orderly and consistent* *with U.S. policy on consideration and protection of the environment; to maintain a posture sufficient to protect our national security interests and preserve the principle of freedom of the seas and superjacent airspace; to develop and implement programs and activities, within a framework of international cooperation wherever appropriate and feasible…"* U.S. policy should also *include "mutually beneficial cooperation with Arctic and other countries in exploration, scientific research, resource development and exchange of scientific and technical data."* The decision memorandum also called for the creation of an interagency Arctic policy group to review and coordinate U.S. policy in the Arctic.

A decade later, the Reagan Administration would re-affirm the basic tenets of these policies with another National Security Decision Directive [9], which stated: *"the United States has unique and critical interests in the Arctic region related directly to national defense, resource and energy development, scientific inquiry, and environmental protection…"* and specifically recommitted the United States to promoting *"beneficial international cooperation"*. A major new element to move the ball forward was introduced with the enactment of the Arctic Research and Policy Act of 1984, which established the new independent national Arctic Research Commission to oversee and coordinate U.S. scientific efforts in the Arctic, as well as the Interagency Arctic Research Policy Committee, which would do the same for U.S. federal agencies.

The international efforts in the late 1980s – the Murmansk speech by Soviet leader Mikhail Gorbachev, described above, and the global push for greater Arctic cooperation -led the United States to review its Arctic policy, which was initiated by a public forum and conference sponsored by the U.S. Department of State in Alaska in 1993, and would result in a new Presidential Decision Directive involving the Arctic the following year. As with previous directives, the broad thrust of policy principles remained the same, although, for the first time, U.S. policy emphasized the importance of indigenous communities in decision making and policy development.

While the broad Arctic policy goals have underlain U.S. policy for recent decades, towards the end of the second term of the Bush administration, it was concluded that it was an appropriate time to review U.S. policy. Fourteen years had passed since the last federal Arctic policy review, and there had been several notable changes to take into consideration. The growing concern of the need to understand the causes and effects of climate change on the planet, especially in the Arctic, had caused all northern countries to reassess their activities in the Arctic. The United States, for its part, had taken the lead in the late 1990s, to initiate the Arctic Climate Impact Assessment [1], under the auspices of the Arctic Council. In addition, many of the initiatives to develop greater multilateral cooperation in the North, leading to the formation of the Arctic Council, had happened after the last policy review, and needed to be taken into account. Rapid change in the extent and thickness of Arctic ice shelf and sea ice is leading to increased maritime activity, which in turn raises new questions about the possible expansion of fisheries, increased pollution, shipping, new forms of energy exploration and development, and, collectively, potential new questions about the entire scope of sustainable and economic development in the region.

For these reasons, the Administration undertook an intensive interagency review, which included input from a wide variety of U.S. players and stakeholders, such as the

State of Alaska, indigenous groups, environmental leaders, industry representatives, as well as members of the academic and research community. After extensive interagency discussions and meetings of the government with various stakeholders, the Administration released the updated policy in January, 2009. The revised National Security Presidential Directive [11], which kept the central six central tenets of previous Arctic policies intact, was a non-political document and represented goals which might appropriately be called bipartisan. Early in the new term, the Obama Administration reaffirmed that the 2009 Presidential directive from the Bush Administration continues to accurately describe U.S Arctic policy, thereby retaining the same broad six policy goals first expressed in the 1994 Arctic policy of the Clinton Administration:

1. Meet national security and homeland security needs relevant to the Arctic region;
2. Protect the Arctic environment and conserve its biological resources;
3. Ensure that natural resource management and economic development in the region are environmentally sustainable;
4. Strengthen institutions for cooperation among the eight Arctic nations (Canada, Denmark, Finland, Iceland, Norway, Russia, Sweden and the United States);
5. Involve the Arctic's indigenous communities in decisions that affect them; and
6. Enhance scientific monitoring and research into local, regional, and global environmental issues.

It is important to remember that the Bush Administration worked for eight years under the Arctic directive that had been developed by the Clinton Administration, which reflects the constant nature of U.S. fundamental interests and objectives in the North, regardless of which political party is in power. While these basic U.S. interests and objectives in the Arctic endure and have not changed much from the prior directives, there have been new developments which are a reflection of the changes that have been taking place in the Arctic. U.S. domestic policies on homeland security and defense have changed significantly since September 11, 2001. The United States has fundamental homeland security interests in preventing terrorist attacks and criminal or hostile acts in or via the Arctic domain. There had also been time to reflect on the progress made under the Arctic Council. Finally, there was a need to consider the above mentioned potential increases in shipping and economic activity, as well as how best to prepare for possible rapid changes in the environment.

9.3 Current Major Issues for U.S. Arctic Policy

9.3.1 Arctic Security Issues

The collapse of the Soviet Union and the end of the Cold War has clearly lowered the threat of traditional security issues in the Arctic, but the potential increase in transportation and other human activities due to the melting of polar ice, certainly raises new concerns and calls for a renewed focus on potential new conditions. As a result, the current U.S. policy directive calls for *"greater capabilities and capacity, as necessary, to protect United States air, land, and sea borders in the Arctic region."* The recent Department of Defense (DoD) *Quadrennial Defense Review* [15] stated:

> The effect of changing climate on the Department's operating environment is evident in the maritime commons in the Arctic. The opening of the Arctic waters in the decades ahead which will permit seasonal commerce and transit presents a unique opportunity to work collaboratively in multilateral forums to promote a balanced approach to improving human and environmental security in the region. In that effort, DoD must work with the Coast Guard and the Department of Homeland Security to address gaps in Arctic communications, domain awareness, search and rescue, and environmental observation and forecasting capabilities to support both current and future planning and operations. To support cooperative engagement in the Arctic, DoD strongly supports accession to the United Nations Convention on the Law of the Sea. As climate science advances, the Department will regularly reevaluate climate change risks and opportunities in order to develop policies and plans to manage its effects on the Department's operating environment, missions, and facilities. Managing the national security effects of climate change will require DoD to work collaboratively, through a whole-of-government approach, with both traditional allies and new partners.

This does not reflect any heightened tensions in the area, but rather is simply a prudent response to new conditions, driven largely by potential new evolving economic interests. All eight members of the Arctic Council have recently reviewed their Arctic policies and made similar statements about the need to examine their capabilities to respond to changes taking place in the Arctic.

The Department of Defense is taking a number of steps to implement the Quadrennial Defense Review, to include formally assessing capabilities needed to responsibly prepare for operations in a more-accessible Arctic and developing plans, such as *Navy's Arctic Roadmap* [18], to address capability gaps in areas such as communications and ice and weather forecasting, which will also support implementation of the recently-signed *Search and Rescue agreement* by all of the Arctic Council member states. The Department has also recently taken steps to streamline command and control relationships in the Arctic to improve continuity of effort and enhance relationships with key regional partners.

9.3.2 Adherence to the United Nations Convention on the Law of the Sea

Although the United States is not yet party to the United Nations Convention on the *Law of the Sea* [17], the United States has long considered that, with respect to traditional uses of the ocean, the Convention generally reflects customary international law and these provisions are thus binding on the United States. UNCLOS is the fundamental legal instrument governing activities on, over, and under the world's oceans, and has the complete support of the Obama Administration. With respect to accession to the Convention, it remains an important goal of the Obama Administration to secure Senate approval of UNCLOS. Every Administration – whether Democratic or Republican – since the treaty was first submitted to the Senate in 1994 has supported U.S. accession to the Convention and ratification of the associated 1994 Agreement. The Obama Administration is working closely with Senate leadership for the Senate to take up this important treaty at the earliest opportunity. The other four Arctic coastal states (Canada, Denmark, Norway, and Russia) are parties to the Convention. United States accession UNCLOS would further our national security, environmental, economic, and diplomatic interests, and would reaffirm U.S. leadership in this arena.

The importance of the law of the sea and its role in the Arctic is reflected in the *Ilulissat Declaration* [8] adopted by the five Arctic coastal states: it explicitly recognizes that "an extensive international legal framework applies to the Arctic Ocean. Notably, the law of the sea provides for important rights and obligations concerning delineation of the outer limits of the continental shelf, the protection of the marine environment including ice-covered areas, freedom of navigation, marine scientific research, and other uses of the sea."

Another important reason to become a party to the UNCLOS is because of the interests of non-Arctic states in the Arctic. The Convention divides ocean areas – both the water column and the seafloor – into different zones, with States enjoying varying rights in each zone. The five coastal States of the Arctic thus do not *"control"* or *"own"* the entire Arctic Ocean. All states, for instance, may exercise freedoms of navigation and overflight in areas beyond the territorial sea. Thus, while non-Arctic States may have legitimate interests in the Arctic Ocean, these are carefully defined by the UNCLOS.

Lastly, we have not been able to nominate an expert for election to the Commission on the Limits of the Continental Shelf (CLCS), which reviews countries' submissions for delimiting their continental shelves. Thus, until we become a party to the Convention, we cannot participate fully in the review process, nor even nominate American commissioners to review the detailed data submitted by other countries on the limits of their continental shelves beyond 200 nm.

9.3.3 Continental Shelf Concerns

The United States is also eager to delineate the outer limits of its continental shelf beyond 200 nautical miles, which would be reviewed under the provisions of the UNCLOS. A coastal State exercises certain sovereign rights over its continental shelf, including exploration, exploitation, conservation, and management of non-living resources, such as oil, gas, minerals, and living, "sedentary" species, such as clams, crabs, and sponges. The United States has vast areas – at least twice the size of California and, in the Arctic, at least as far as 600 miles from the coastline – of continental shelf. Parties to the Convention have access to the expert body – the CLCS, whose technical recommendations assist a coastal state in establishing the outer limits of its continental shelf.

9.3.4 Changes in Governance

The United States believes that the primary focus of the Arctic Council should remain its excellent work in the areas of environmental protection and sustainable development, but we also recognize that changing conditions in the Arctic present us with the opportunity to expand and broaden our cooperation in the region. Multilateral cooperation in the Arctic has improved steadily since the adoption of the Arctic Environment Protection Strategy and later, the Arctic Council, and the organizational elements have been adjusting to new challenges. The United States is actively engaged in efforts to improve the effectiveness and efficiency of the forum, in accordance with its general mandate. In this regard, at its last meeting in Nuuk in 2011, the Council agreed to establish a new Secretariat in Norway. Evolving challenges frequently require creative solutions, and in this regard, Council members also signed an agreement for search and rescue cooperation, the first time all eight Arctic countries have adopted a legally-binding agreement under the Council's auspices. They have also begun negotiations on an agreement on Arctic marine oil spill pollution preparedness and response, and are further exploring possible measures that can be taken to address the climate impacts of black carbon and other short-lived climate forcers. Other potential areas, which may need further attention include shipping, energy and other resource development, and fisheries. Finally, there is a growing interest by non-Arctic countries in the region, with increased demands for a larger role in the Arctic Council.

9.3.5 Jurisdictional Questions

Beaufort Sea

The United States and Canada disagree about the location of their maritime boundary in the Beaufort Sea. Canada claims that the land boundary dividing Alaska from the Yukon Territory, the 141st line of longitude, should also be the maritime boundary heading due north. The United States claims that the maritime boundary should be an equidistant line out to 200 nautical miles, i.e., a series of points that are equidistant to the nearest points of land in each country. As a result of this difference of view, both States claim a roughly triangular area in the Beaufort Sea covering approximately 6,100 square nautical miles. Both States have offered oil and gas leasing blocks in the disputed area, but neither side has moved forward with drilling. There are no fishery resources of consequence in this area at this time.

The United States has periodically suggested to Canada that the two sides attempt to reach agreement on all four disputed maritime boundaries (the others are in the Dixon Entrance, outside the Strait of Juan de Fuca and in the Gulf of Maine), and Canada has recently suggested that there is political willingness in Canada to discuss resolution of the Beaufort Sea maritime boundary.

Northwest Passage

Although Canada regards the Northwest Passage, which connects Baffin Bay/Davis Strait in the Atlantic with the Beaufort Sea in the Arctic Ocean, as "internal waters" through which there are no passage rights, the United States, and most other maritime powers, regard the Northwest Passage as a strait used for international navigation – the same status as the Strait of Gibraltar, for example – through which vessels enjoy the right of transit passage.

The U.S. recognizes Canadian sovereignty over its Arctic islands as well as its sovereignty over territorial seas adjacent to those islands. The U.S., however, has long disputed Canada's "straight baselines" that attempt to enclose much of Canada's arctic waters as *"internal waters."* Those straight baselines are not drawn in a manner consistent with the provisions of the Law of the Sea Convention. The United States also has concerns about Canada's mandatory requirements for foreign-flagged ships transiting Canadian-claimed Arctic waters, commonly referred to as "NORDREG," and has recommended that they be submitted to the International Maritime Organization for review. Lastly, there is also a bilateral agreement between the two countries on navigation and transit of ice-covered areas by research vessels [2], which affects this strait.

9.3.6 Science

Given the need for decisions to be based on sound scientific and socioeconomic information, we must work with other Arctic countries to promote unfettered scientific research on a host of Arctic issues, including climate change and its effects. The United States has already made significant investments in the infrastructure needed to collect environmental data in the Arctic, and we welcome the investments others are making to advance research in the Arctic. The United States will seek the involvement of all Arctic nations in order to advance scientific understanding that could provide the basis for assessing future impacts of climate change and proposed response strategies.

9.3.7 Energy and Natural Resources

The United States also recognizes that energy development in the Arctic will play an important role in meeting growing demand for energy resources, and commits the United States to ensure that energy development in the Arctic occurs in an environmentally sustainable manner, taking account of the interests of indigenous and other local communities as well as open and transparent market principles.

With regard to natural living resources, the United States will continue to identify ways to conserve, protect, and sustainably manage Arctic species affected by climate change and increased human activity. For species whose ranges include areas both within and beyond U.S. jurisdiction, the United States will continue to collaborate with other governments to ensure effective conservation and management.

9.4 Summary

The last few decades have seen a remarkable evolution in the policies of countries in the Arctic region towards greater engagement and mutually beneficial efforts. Starting from the era of tensions and confrontation of the Cold War, Arctic countries have created new mechanisms to foster greater regional cooperation. While the broad trends of greater global inter-connectedness have helped this cooperation, the increased awareness of policy makers in the United States of the benefits of pursuing regional approaches to share information and approaches to solutions has led to recognition that many of its problems in the Arctic are better solved through regional approaches. U.S. Arctic policy has always recognized this fact, but the benefits of this growing cooperation are more apparent than ever.

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Chapter 10
The Environmental Component of the National Maritime Policy of the Russian Federation in the Arctic Ocean

Dariya V. Vasilevskaya, Alexander V. Nikolaev, and Grigory I. Tsoy

Abstract Russia as a leading maritime power that earned *"this status because of geographical location with access to three oceans and sea borders, as well as a tremendous contribution to the study of the oceans, to the development of shipping, many great discoveries made by famous Russian navigators and adventurers*" (Russian Federation (2001) Maritime Doctrine of Russian Federation until 2020. Approved by the President of the Russian Federation, 27 July 2001. Pr-1387). The Russian state is implementing a national marine policy through its public authorities on a regional basis. Russian companies are involved in the development and implementation of national maritime policy through their representatives in federal and local governments and different associations operating on the basis of the Russian Constitution and the laws of the Russian Federation.

10.1 Russian National Interests in the Ocean

The Russian Federation has diverse national interests in the ocean that involve inviolability of the sovereignty of the Russian Federation, covering the internal maritime waters, territorial sea and the airspace above them, on the floor and subsoil. In addition, sovereign rights and jurisdiction of the Russian Federation, are carried out in the exclusive economic zone and continental shelf of the Russian Federation for the exploration,

D.V. Vasilevskaya (✉) • G.I. Tsoy
Department of the State Policy and Regulation in the Area of Geology and Subsoil Use, Ministry of Natural Resources, Russian Federation, Moscow, Russia
e-mail: dvasilevskaya@mail.ru; tsoy@mnr.gov.ru

A.V. Nikolaev
Scientific and Expert Council, Maritime Collegium to the Government, Russian Federation, Moscow, Russia
e-mail: sopspravo@mail.ru

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development and conservation of natural resources. These natural resources are both living and non-living at the bottom, in the subsoil and the superjacent waters.

Management of Russian marine resources involves energy production through the use of water, streams and wind as well as the creation and use of artificial islands, installations and structures. The management activities include protection of human life at sea as well as control of the vital sea communications for the benefit of maritime economic activities of the Russian Federation, especially its coastal regions. In addition, these management activities include marine scientific research as well as the protection and preservation of the marine environment, especially the prevention of marine pollution.

Importantly, national interests of the Russian Federation involve the protection of its borders both on land and at sea as well as in the airspace. As major regions in of interest, the national maritime policy of the Russian Federation [4] lists the following area along with their characteristics: Arctic, Atlantic, Pacific and Indian Oceans as well as the Caspian sea. Beyond national jurisdictions, Russia has freedoms of the high seas that include freedoms of navigation, overflight, laying of submarine cables and pipelines, constructing artificial islands, fishing and scientific research, as provided by the *United Nations Convention on the Law of the Sea* [6].

10.2 Russian Maritime Policy

Key principles of the national maritime policy of the Russian Federation [4] are:

1. Compliance with generally accepted principles and rules of international law and international treaties of the Russian Federation in the course of maritime activities;
2. Priority of political and diplomatic, economic and other non-military means in resolving conflicts in the oceans and the removal of threats to national security of the Russian Federation in marine areas;
3. Possession of the necessary naval capabilities and its effective use, in case of aggression against the Russian Federation;
4. Integrated approach to maritime activities in general and its differentiation in certain areas, taking into account the changes of priorities depending on the geopolitical situation;
5. Maintenance of maritime capabilities the Russian Federation at levels consistent with the national interests of Russia;
6. Interaction and coordination in the formulation and implementation of national maritime policy of the state authorities of the Russian Federation, the state authorities of the subjects of the Russian Federation, local governments and public interest groups, based on the Constitution and laws of the Russian Federation;
7. Joint efforts and coordination of research on the formation and implementation of national maritime policy;
8. State control over vessels flying the State flag of the Russian Federation, port state control, monitoring and use of natural resources, internal sea waters, territorial sea, exclusive economic zone and continental shelf of the Russian Federation;

9. Focusing on construction and infrastructure development the Russian fleet in the territories of the Russian Federation, traditionally associated with sailing, the harmonization of the infrastructure with defense and economic needs;
10. Maintenance of the Russian fleet in readiness to address challenges, as well as mobilization readiness of the trade, fisheries, research and other specialized fleets;
11. Concentration of funds and resources of the center and the regions for the development of communications between the central and coastal parts of Russia, especially its far eastern and northern outskirts, for their further development;
12. Integrated marine scientific research in the interests of the Russian Federation, the development of systems for monitoring the marine environment and coastal areas;
13. Preservation and improvement of training, education and upbringing of young people; and
14. Effective advocacy of the national maritime policy.

10.3 Russian Maritime Policy for the Arctic

With regard to the Arctic region, the national maritime policy of the Russian Federation [4] reflects the particular importance of providing unimpeded access of the Russian fleet, including to its Baltic Sea territories, and the crucial role of the Northern Fleet for defense of the state. In addition, high importance is attached to the wealth of the exclusive economic zone and continental shelf in the Arctic Ocean as well as to the Northern Sea Route, which has significant implications for sustainable development of the Russian Federation. In this context, the following long-term objectives have been formulated:

- Research and development of the Arctic, including development of export-oriented economic sectors, while providing for priority of social security;
- Protecting the national interests of the Russian Federation in the Arctic;
- Creation of ice-class vessels for shipping, specialized vessels for fishing, research and other specialized fleets;
- Exploration and development of bio-resources and reserves of mineral resources in the exclusive economic zone and on the continental shelf of the Russian Federation;
- Ensuring the protection of sovereignty, sovereign and international rights of the Russian Federation in the Arctic region;
- Ensuring the national interests of the Russian Federation in relation to the Northern Sea Route, optimal governance of the transport system, icebreaking services and equitable access of interested carriers, including foreign carriers to the Northern Sea Route;
- Updating and safe operation of nuclear icebreaker fleet;
- Ensuring the interests of the Russian Federation in the delimitation between the Arctic coastal States of surface areas and the bottom of the Arctic Ocean; and

- Consolidation of efforts and resources of the federal center and the regions of the Russian Federation in order to develop the Arctic shipping, the marine, estuarine and river ports and to continue "the Northern delivery" of economic goods to remote Northern areas of the Russian Arctic, as well as of information systems.

Economic activity usually exerts additional pressure on the environment. The aim of the Russian state and authorized bodies in the area of environmental protection is to minimize negative impact of human activity on the environment. Anthropogenic, social and economic factors especially affect the Arctic environment. Marine ecosystem stability in the Arctic Ocean is more vulnerable to impacts than in the lower latitudes [3]. Biochemical disintegration of various organic pollutants is much more slower due the effects of temperature and many organic pollutants are resilient to decomposition in Arctic ecosystems [1]. The growing demand for natural resources in the Arctic and their development call for much closer cooperation of Arctic coastal states, who have primary responsibilities for the Arctic environment.

Today legal regulation of economic activity in the Arctic should be developed in full awareness of the fragility of the Arctic ecosystem and it's great role in the well being of the biosphere as a whole. The nature of the High North exists now under great pressure of different kinds of economic activity. Such activities, especially development of oil and gas fields can produce destructive, irreversible and very often transboundary impacts on Arctic nature.

For centuries the Arctic potential attracted scientific and economic attention. Since the sixteenth to seventeenth centuries, when governors and merchants organized rare research expeditions to the North, economic interests were focused on new shipping routes and exploitation of the marine living resources, while coastal communities exploited them in a rather moderate way. The situation changed when European industry came into the Arctic, the large-scale activity caused irreversible damage to many Arctic fauna. Fur-seals and Greenland whales were nearly annihilated, some species unfortunately disappeared, for example, the Stellar sea cow. Today the impact of unregulated industrial human activity on the Arctic environment continues to be sometimes devastating. However, some species have been formally put under legal rules and international protection, such polar bears (*Agreement on the Conservation of Polar Bears, 1973,* signed by the five Arctic coastal states).

The danger for the arctic ecosystem became much more serious in the end of the twentieth century when the influence of the private oil sector on governmental bodies in Russia increased sharply (in comparison to the situation during the Soviet era). Through the Northern Sea Route, prevailing economic interests of the country are concentrating not on fisheries and shipping (products of first necessity to Russian coastal communities), but rather on new Arctic mineral resources and the development thereof, including that of the continental shelf. It is in the 1990s that the new market economy of the Russian Federation, as well as the old market economies of the United States, Canada, Norway and Denmark encouraged more intense exploration of Arctic shelf natural resources, oil and gas in particular [9].

For the Arctic as a whole, according to the United States Geological Survey [7], there is estimated to be *"90 billion barrels of oil, 1,669 trillion cubic feet of natural gas, and 44 billion barrels of natural gas liquids may remain to be found in the*

Arctic, of which approximately 84 percent is expected to occur in offshore areas." According to some expert assessments, 20–46 billion tons of oil and 0.5–1.5 trillion cubic meters of gas are deposited in the sea sub-soil areas adjacent to the coasts of the Russian Federation alone. Consequently, there is a serious necessity for greater responsibility of the Russian Federation to protect the Arctic region and there is an international expectation for Russia to contribute such protection.

The Russian Federation is undertaking various steps to form effective legal frameworks for using and protecting Arctic resources [8]. A draft of *"Strategic Program of Protecting the Arctic Marine Environment from Pollution"* was developed with the assistance of the United Nations Environmental Programme (UNEP). This draft was prepared in the context of consultations with federal and regional authorities, business and public opinion. The draft also was designed to complement the maritime doctrine of the Russian Federation [4]. The strategic program to protect the Arctic marine environment is being developed with concentration on the following environmental issues:

- Pollution, including transboundary transfer of pollutants by air and water currents;
- Chemical and radioactive pollution;
- Pollution of water resources;
- Losses of biodiversity;
- Destruction of traditional environment of the indigenous communities;
- Degradation of soil; and
- Increasing danger to the climate at the global level.

Taking into account these environmental issues as well as their complicated and long-term character, it is a high priority to prevent oil, chemical and radioactive pollution of the marine environment. The preventive measures are associated with the diverse resource exploitation activities, including impacts to indigenous peoples and risks related to natural disasters.

To realize these large goals, it is necessary to create constructive legal and institutional structures, implying first of all to develop and improve the existing legislative basis for better management of oil and gas sectors. In addition, it is necessary to form innovative legislative acts that better correspond to contemporary international and foreign environmental law and concepts (e.g., environmental impact assessment; "polluter pays" principle; precautionary approach; mechanisms for rehabilitation of damaged lands; liability for past damage; and social responsibility of businesses). Such acts would be aimed specifically to provide an environmentally healthy regulatory framework for oil and gas activities in the Arctic region, including: pipelines; transportation of oil and gas by vessels; management of wastes; and harmonization with other activities in the sea, especially fisheries. Such new acts would be even more advanced than the contemporary legal environmental approaches adopted in the European Union and United States bearing in mind the recent ecological collapse in the Gulf of Mexico to which United States environmental law turned out to be unprepared ([2]; *Deepwater Horizon* Commission Staff Paper, this book). More effective cooperation among the Arctic states for ecological conservation of this unique region of global value means *inter alia* that ecological collapses like that of the Gulf of Mexico should never to occur in the Arctic Ocean.

Concepts in the draft Russian federal law *"On Special Regimes of Wildlife Management and Protection of the Environment in the Arctic Zone of the Russian Federation"* have been developed in line with the Constitution of the Russian Federation, special acts of the President of the Russian Federation and Government of the Russian Federation across Arctic regions. Current legislation of the Russian Federation in the sphere of wildlife management and environment protection also complements UNEP frameworks as represented by *"The Russian Federation – Support of the National Plan of Action on Protection of the Arctic Sea Environment."*

Basic ideas of Russian Arctic sea environmental law complements provisions stated in Arctic policy of the Russian Federation [5], which aims to maintain and strengthen the role of Russia as a leading Arctic power. Strategic priorities and mechanisms of realization of the state policy of the Russian Federation [5] in the Arctic, further provide a system of legal, organizational, economic, scientific, technical and other measures associated with the maintenance of national environmental security of Russia to:

- Understand the place and role of Russia in maintaining Arctic ecosystem balance and biodiversity preservation (according to some estimates, the Russian zone includes about 80 % of all Arctic species, surpassing the cumulative biodiversity contributions of all other Arctic states);
- Protection the economic and geopolitical interests of Russia;
- Expand the Russian Arctic resource base to satisfy the needs of Russia with regard to hydrocarbons, water, biota and strategic raw materials;
- Preserve, maintain and protect the Arctic environment and its unique ecological systems as well as the habitats of Arctic indigenous peoples;
- Mitigate ecological consequences of economic activities, especially in view of global climate changes;
- Enhance the fair and full performance by the Russian Federation to fulfill its international obligations in the sphere of environmental security.

These purposes may be most expediently achieved through the establishment of special regimes of wildlife management and protection of the Arctic environment.

Purposes of the Russian environmental law are to create effective organizational, economic and social bases to establish special regimes of wildlife management and protection of the Arctic taking into account extreme natural-climatic conditions and instability of ecological systems of the region. It is further recognized that Russian environmental law involves:

- Strengthening the responsibility of regional authorities of Russia for ecological consequences of economic and other activities within their respective territories;
- Creating a system of legal guarantees of environmental security within the limits of sea areas, including coastal and other territories; and
- Stimulating investments into natural resources development with regard to industrial, transport and other infrastructures.

The draft Russian federal law provides for special regimes of wildlife management and protection of the environment in the Russian Arctic.

Cleaning and rehabilitation of damaged Arctic lands of the Russian North is another key sphere, which requires substantial legal and financial resources. Damaged lands expand negative impact on both terrestrial and marine environments, particularly in coastal zones. Legal experiences from the European Union and United States already are being analyzed by Russian law researchers, but that is not sufficient. The intellectual gap between researchers and decision-makers (from business and ministerial circles) is now significant and political will is needed to adopt relevant practical instruments accordingly.

All these environmental steps can be effectively realized in a more constructive way in close cooperation of Arctic and non-Arctic state, international and national institutions, regional and municipal authorities, businesses, indigenous peoples, scientists and the public.

Russia is willing to realize its Arctic activities taking into account rigid environmental requirements. This is a national compelling position especially in terms of developing the: Yamal Peninsula resources; Shtokman oil and gas deposits in the Barents Sea, northern part of the Krasnoyarsk region and Yakutia; and hundreds of other industrial and infrastructure projects emerging from both governmental and business circles. The Russian state plans to introduce resources saving technologies that will be in harmony with nature. Russian authorities have already emphasized some basic priorities in the Arctic. Among them to:

- Create favorable living conditions, including solicitous attitude to traditions and economic set-up of indigenous and low-numbered native peoples of the Arctic;
- Stabilize the economic growth, attracting substantial amount of domestic and foreign investments in the region; and
- Invest capital in scientific environmental infrastructure.

The Russian government plans to "*clean the Russian Arctic*" from the dumps that have been piled-up for decades round polar cities and settlements, military bases, ports, in tundra, on islands and in other areas of the Russian Arctic. The Ministry of Natural Resources and Environment of the Russian Federation develops a set of environmental measures in the Arctic regions owing to active development of this region.

One of the measures is to protect coastal zones against oil spill. At present, the draft federal law *"On the Protection of the Marine Coastal Zones Against Oil Spill"* has been agreed upon by the corresponding ministries and departments. This draft law provides, in particular, for an institute of obligatory insurance against environmental risks, which are particularly relevant to hydrocarbon resource exploitation on the continental shelf. In order to modernize the system of environmental monitoring in the Arctic, the Russian state plans to create a multi-purpose Russian space system "Arctic."

The government also makes provision for a set of surveys of accumulated waste and pollution caused by industrial factors. The network of reserves in the Arctic will be extended. The Russian state further is making provisions to create marine environmental security zones, namely the: *Kandalaksha Environmental Reserve* in the area of the Barents Sea next to the Murmansk province, and the *Tajmyrsky Environmental Reserve* in the part of the Laptev Sea next to the Krasnoyarsk province. These protected areas will complement the nine reserves, national park and two federal nature reserves that already exist in the Russian Arctic today. The new national park *"Russian Arctic"* was established last year with an area that is greater than 1,500,000 ha.

The Ministry of Natural Resources and Environment of the Russian Federation has worked out a draft federal law, which will oblige all companies developing natural resources of the Arctic continental shelf to insure against the environmental risks of their activities. A special state fund will be created for these purposes and the insurance sum will be calculated individually for each project depending on its specificities.

10.4 Conclusion

The position of the Ministry of Natural Resources and Environment of the Russian Federation is that the Arctic states are to think and to act in political and legal harmony to ensure environmental safety when economic operations are involved in the Arctic (especially when mining installations are involved). Of special significance is a proper balance between interests associated with sustainable activities (e.g., fisheries, recreation and subsistence harvesting by indigenous peoples) and more influential 'big-business' industries (e.g., oil and gas sector). Recognizing the environmental problems and poorly regulated economic activities in the Russian Arctic, especially in view of growing international concern about environmental protection in the Arctic generally, there is high probability that environmental protection laws will grow significantly at regional and national levels in the Russian Federation.

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Chapter 11
Keynote Speech: 'Canada's Arctic Foreign Policy'

James R. Wright

Ladies and Gentlemen,

Thank you Paul Berkman for the invitation to speak here this evening. It is always a pleasure to be back at Cambridge, and especially to be here as a guest of the Scott Polar Research Institute. Our event tonight builds on a highly valued partnership between the Institute and the Canadian High Commission. The central theme for our collaboration is, of course, the Arctic, and, tonight, I am delighted to speak about Canada's Arctic Foreign Policy to such an audience of distinguished experts. I don't pretend to be an expert myself, but the Arctic has been something of a constant theme throughout my career in Canada's foreign service.

In fact, my very first posting was to Moscow in 1978 – where an Arctic dialogue was part of my discussions with our Russian friends. Even back then, we were fostering links between scientists, cultural anthropologists, First Nations, the business community and of course governments. And we were discussing the concept of an Arctic bridge linking Canada and the then Soviet Union – fostering air links over the North Pole and new shipping lanes to speed up commerce between North America and Europe. Sound familiar?

Many years later, I was fortunate to oversee the work of Canada's "Circumpolar Ambassador". And, as Political Director for Canada, in 2002, I negotiated with Moscow the G8 $20 billion Global Partnership Program addressing the Cold War legacy of WMD [Weapons of Mass Destruction] in the former Soviet Union. A key element of that program was safely disposing of several hundred decommissioned nuclear submarines that risked seriously polluting the Arctic. So you might say, what goes around comes around.

"The Arctic" is nothing new to those of us who live and work in Arctic countries. That said, there is no denying the tremendous growth in interest from the outside

J.R. Wright (✉)
Canadian High Commission, Macdonald House 1 Grosvenor Square, London W1K 4AB, UK
e-mail: pamela.strigo@international.gc.ca

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world in all things circumpolar. The Arctic is front-and-centre in newspapers, on web-pages, in academic journals and at events such as this at the Scott Polar Research Institute. The world sees a region in the midst of an "environmental state-change" in the words of our host tonight, Paul Berkman. Science tells us that in the coming decades, the Arctic Ocean will transform from a permanent sea-ice cap to a seasonally ice-free sea.

The growing interest has sometimes been paired with excitable commentary to suggest that the Arctic is the globe's final "terra nullius". A concept that the millions who call the Arctic home would find at the very least bemusing. This includes more than 125,000 Canadians across three territories – the Yukon, the Northwest Territories and Nunavut – many of whom are Inuit, First Nations and Métis, whose ancestors have inhabited the region for millennia.

More thoughtful commentators have started to analyse the real opportunities and challenges for the region that are emerging as a result of the melting sea ice. In the past 2 days you will, no doubt, have discussed the commercial opportunities that are emerging, whether from the natural resource sector or in the eventual opening up of new sea trade routes. There are exciting opportunities for scientific collaboration. But we also face challenges: commercial development must be balanced with the need to protect the North's unique and fragile eco-system. Above all, development in the Arctic must benefit Northerners.

All the Arctic countries – the eight members of the Arctic Council – have articulated strategies for managing the coming decades of change. The Government of Canada publicly launched its *Northern Strategy* in the summer of 2009. Based on four mutually reinforcing pillars, our vision for the Arctic is a stable, rules-based region with:

- clearly defined boundaries;
- dynamic economic growth and trade;
- vibrant Northern communities; and
- healthy and productive eco-systems.

A great deal of the work that flows from our Northern Strategy is to be done at home – including further improving and devolving Northern governance. I cannot emphasise this point enough. We are a northern country. The vast expanse of our Arctic – indeed 40 % of our landmass – is an integral part of Canada. We are responding through public policy to changes in the Arctic, as we would to changes in any part of our country: from coast to coast to coast.

At the same time, we recognise that the geopolitical significance of the region and the implications for Canada have never been greater – which is why we have placed the Arctic at the top of our foreign policy agenda. Since taking office in 2006, Prime Minister Harper has made a point of travelling to the North each year. And this past summer, Foreign Minister Lawrence Cannon issued a "*Statement on Canada's Arctic Foreign Policy*" – a clear articulation of the international dimension of our Northern Strategy.

Since foreign policy is what I know best, I will focus my remarks on this Statement.

Sovereignty is Canada's number one Arctic Foreign Policy priority – an issue that is closely connected with governance in the Arctic. Let me discuss these two priorities in turn.

11.1 Sovereignty

Canada's sovereignty in the Arctic is long-standing, well-established and based on historic title. It derives in part from the presence of the Inuit and other Indigenous peoples since time immemorial. In the presence of Julian Dowdeswell [director of the Scott Polar Research Institute], I must, of course, give a mention to the role played by British explorers in helping to map the vast Arctic territory that was eventually transferred by Great Britain to the Dominion of Canada in 1880. The museum at Scott Polar does a superb job in showcasing some of these expeditions, including Franklin's ill-fated attempt to sail through the Northwest Passage.

Today, Canada exercises its sovereignty daily through good governance and responsible stewardship, whether related to social and economic development, Arctic science and research, environmental protection, the operations of the Canadian Forces or the activities of our Coast Guard.

Our foreign policy priority on Arctic sovereignty is to settle our borders in the North: on land, in the sea and on the sea-bed. As the North becomes increasingly accessible for commercial activities, it is incumbent on governments to resolve differences and to ensure appropriate regulatory regimes in order to provide certainty and stability for the region. Without clarity on boundaries, the viability and sustainability of the Arctic could be at risk. That's why making progress on outstanding boundary issues is a priority for Canada.

Although such issues have been well-managed and pose no security challenges, lingering questions create uncertainties and fuel misperceptions of potential conflict. So, we are engaging with the United States and Denmark on remaining disputed boundaries in the Beaufort Sea, Lincoln Sea and Hans Island.

And we were encouraged by the example set by Norway and Russia – who recently settled their Barents Sea maritime dispute after 40 years of extensive negotiations.

With regards to the sea bed, the Canadian government has given high priority to securing recognition for the full extent of the extended continental shelf. We are increasing our collaboration with our partners on data collection and information exchange to expedite this process.

Canada will make its submission to the United Nations *on schedule in 2013*, in conformity with the *United Nations Convention on the Law of the Sea*.

11.2 Addressing Arctic Governance

Let me turn to our second priority – addressing Arctic governance. With the world's attention turning northward, many players far removed from the region are seeking a role and in some instances calling into question the governance of the Arctic.

My government's position is very clear: Canada *does not accept* the premise that the Arctic requires a fundamentally new governance structure or legal framework. Nor does Canada accept that the Arctic nation states are unable to appropriately manage the North as it undergoes fundamental change.

Canada, like other Arctic nations, stands by the extensive international legal framework that applies to the Arctic Ocean. Notably, the United Nations Convention on the Law of the Sea provides not only the legal basis for delineation of continental shelves, but goes well beyond this to address:

- the protection of the marine environment;
- freedom of navigation;
- marine scientific research;
- conservation and utilization of marine living resources; and
- other uses of the sea

But, we do accept that within this broad legal framework, the North is undergoing fundamental change.

For example, until now, the Arctic Ocean's inaccessibility has meant that the region was largely insulated from the sort of public safety and law enforcement challenges present in regions further south. Decreasing ice cover will lead to, over time, increases in shipping, tourism and economic development in the Arctic region. In response to this expected increase in traffic, we have started to consider how to respond to potential future problems such as environmental emergencies, organized crime and illegal trafficking in drugs and people.

Regional solutions, supported by robust domestic legislation will be critical to ensure public safety. An important initiative that is already underway is the current effort within the Arctic Council to negotiate a legally binding instrument on search and rescue for the Arctic [which was concluded after this speech in Nuuk, Greenland, on 12 May 2011].

Other issues facing the Arctic do not originate in the region, nor can they be addressed regionally. Climate change, the cause of the melting sea ice, is a case-in-point.

Our strategy for addressing Arctic governance can be summarised in three points:

1. enhancing key bilateral relationships;
2. pursuing a strengthened Arctic Council; and
3. working through multilateral institutions.

In the first instance, we are working on enhancing key bilateral relationships. Canada will pursue a more strategic engagement with the U.S. Canada will chair the Arctic Council in 2013, followed by the United States in 2015. We have a mutual interest in developing a North American approach. Similarly, we will work closely with Denmark, Finland, Iceland, Norway, Russia and Sweden in priority areas.

There are other examples of targeted bilateral co-operation. Our work with the UK on Arctic issues is a good example of a productive bilateral relationship with a non-Arctic country. In 2008 we signed a highly valued *MoU on polar science*. This year the Canada UK Colloquium, an annual high level dialogue between our two countries, will focus on the Arctic. In November, some 40 British experts will spend 5 days in Canada, including three in Iqaluit, the capital of Nunavut.

We view the Arctic Council as the leading forum for cooperation on Arctic issues. Through the Arctic Council, Canada, along with seven other Arctic states and six Indigenous Permanent Participation organizations – will set the agenda for co-operation on sustainable development in the Arctic. To be sure, the Council requires some adjustments to achieve that objective. For example, a permanent secretariat and permanent funding need to be considered.

The Arctic has also attracted the interest of non-Arctic states and entities. We must take into account this growing interest of many countries, some very far from the North, to participate in the work of the Council. Canada has long called for objective, principles-based criteria to be developed for those interested in becoming observers to the Arctic Council. Such criteria would benefit both Arctic Council members and applicants for observer status. It would be ill-conceived to proceed with observer applications until fair criteria and a clear role applicable to all are in place.

We also believe, and have long advocated for, a heightened policy role for the Arctic Council. The legally binding search and rescue instrument now being negotiated at the Arctic Council is a first. Canada is playing an active role to insure that this search-and-rescue instrument is signed at the next Arctic Council ministerial meeting. This will serve as a test case and could well pave the way for other such instruments down the road.

Finally, Canada has committed itself to working with other nations, whether it is through the United Nations or the International Maritime Organisation where Arctic issues require a multilateral approach. Working through multilateral institutions for issues such as polar shipping regulations, climate change or mercury emissions is an important component of addressing governance in the Arctic.

To sum up. As we move forward, cooperation, diplomacy and respect for international law will be the hallmarks of our approach to advancing Canada’s Arctic Foreign Policy. In this way, we intend to fulfill our vision of the Arctic as a region of stability, where Arctic states work to foster sustainable development and exercise stewardship for those at the heart of our Arctic foreign policy – Northerners.

Thank you.

Chapter 12
Perspectives from a Non-Arctic Nation: The Case of France*

Maggy Heintz

Abstract Climate change and global warming have put the Arctic Ocean on the politic, economic, scientific and diplomatic agendas worldwide. While the involvement of non-arctic nations in discussions regarding the fate of this still largely pristine part of the world is a bone of contention for many, and particularly for circumpolar countries, ensuring peace and stability in the Arctic Ocean is a matter of global concern. Despite having no inherent strategic interest in the north polar region, France has over the years reinforced its involvement, position and views regarding the future of the northern regions via its scientific, politic and diplomatic actions. This short paper presents a non-exhaustive list of French institutes carrying out scientific research on the poles, some associations and non-governmental organisations aimed at bridging the gap between science and governance, the duty of involvement of France in case of a conflict emerging in the Arctic region, through its position as a Member State in NATO and the European Union, and the diplomatic actions undertaken by the country via the nomination of an Ambassador for the international negotiations on the Arctic and the Antarctic.

12.1 Introduction

Climate change and global warming have triggered over the past decades a cascade of events leading to unprecedented and profound changes in the Arctic region, with deep impacts on its environment and local communities. The region is currently peaceful, with very few signs of neighbouring tensions, and even fewer so since the

*The views expressed in this paper do not necessarily reflect those of the French Embassy in the United Kingdom.

M. Heintz (✉)
Scientific Attache, French Embassy, 6, Cromwell Place, London SW7 2JN, UK
e-mail: maggy.heintz@ambascience.co.uk

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Murmansk bilateral agreement between Russia and Norway, established on 15 September 2010, regarding the Barents Sea delimitation line. The dramatic shrinking of the sea ice cap, doomed to complete seasonal disappearance over summer within the next 30 years, is however opening new opportunities and the Arctic could rapidly become the theatre of political and economic instabilities.

The prospect of new maritime routes between the northern part of the Pacific Ocean and the northern part of the Atlantic Ocean will for instance reduce the current London-Yokohama route, via the Panama Canal, from over 23,335 to 14,630 km, thus representing a tremendous gain of time for commercial shipping.

A circum-Arctic resource appraisal study conducted by the United States Geological Survey [6], estimated that the occurrence of oil and gas in areas north of the Arctic Circle could account for 30 and 13% of yet undiscovered global resources in oil and gas, respectively, representing 10 years of global consumption at the actual rate. 84 % of these resources are expected to occur in offshore areas, mainly on continental shelves of the five neighbouring countries (Canada, United States of America, Russia, Norway and Denmark via Greenland). Apart from oil and gas, nickel, palladium, copper, zinc, diamonds, gas hydrates and geothermal resources are believed to be trapped in the arctic continental shelf, and many of the minerals are also to be found on land within the Arctic.

Energy demand being one of the greatest challenges of the century, it is unavoidable that access to resources in the Arctic is soon going to represent a major political, economic and cultural issue. In the aftermath of the Deepwater Horizon disaster that struck the Gulf of Mexico in April 2010, and considering the challenging and fragile environment of the Arctic Ocean, it is more than ever crucial that nations involved in the exploitation of natural resources in the region work collaboratively and responsibly. While the involvement of non-arctic nations in discussions regarding the fate of the Arctic Ocean is a bone of contention for many, and particularly for circumpolar countries, ensuring peace and stability in this part of the world is a matter of global concern and should be widely and rapidly tackled. The Arctic region has the potential to set up an exemplary framework for shared dialogues and scientific and political diplomacy in order to promote cooperation, prevent conflict and balance national and global interests.

Since the *Treaty of Paris* of 1763 and the rendition of Canada to Great Britain, France has not claimed sovereignty on any piece of land north of the Arctic Circle and thus does not have any inherent strategic interest in the north polar region other than the maintenance of economic and political stabilities. Despite this, France has developed over the years its scientific, politic and diplomatic actions to reinforce its involvement, position and views regarding the future of the northern regions, and has been granted observer status in different intergovernmental forums, despite its lack of geographical presence in the region.

12.2 Science

The French polar science community is very active, and while there is an imbalance between research carried in the Antarctic compared with research in the north, the scientific interest of France in the Arctic is historical. French explorers Paul Emile

Victor and Jean Malaurie were among the first scientists to reach indigenous arctic communities, and Jean Malaurie was in fact the first European to reach the geomagnetic North Pole in 1951. Following the first expeditions and discoveries, establishing a scientific presence in the region has however been a struggle. Any parcel of land above the polar circle belongs to the United States of America, Canada, Russia, Iceland, Norway, Denmark, Sweden or Finland.

The establishment of scientific observatories in the Arctic region has therefore been possible only in the Svalbard archipelago. While international diplomacy acknowledged Norwegian sovereignty on the archipelago, the *Treaty Concerning the Archipelago of Spitsbergen, and Protocol* [4] also recognised that citizens and companies of every nation under the treaty (including France) were allowed to become residents and to undertake any kind of scientific and economic activity in Svalbard. The Charles Rabot and Jean Corbel scientific stations, located in Ny-Ålesund and 5 km away from this “international scientific village”, therefore represent the only French presence in the Arctic. Several research programmes are conducted from these stations, be it ecology and biology of populations, geophysics, atmospheric science, glaciology or oceanography.

Within the scope of the fourth International Polar Year (IPY4 from March 2007 to March 2009), a large collaborative, international scientific programme focused on research in polar regions, with full and equal coverage of both the Arctic and the Antarctic, over 210 scientific projects with thousands of scientists from over 60 nations have been carried out. 58 involved French scientists and scientific institutions (17 in the Arctic, 18 in Antarctica and 23 covering both) and six were under French supervision, led by research institutes such as the *Institut Paul Emile Victor*, IFREMER (Research Institute for the Exploration of the Sea), CNRS (National Centre for Scientific Research) and CEA (Alternative Energies and Atomic Energy Commission). Those are among 20+ organisations in France dedicated to research and studies dealing with the Arctic and the Antarctic.

The *Institut Paul Emile Victor* (IPEV) is the French polar institute, formerly known as the French Institute for Polar Research and Technology (IFRTP) from its creation in 1992 until 2002. IPEV is a public interest group formed by nine public bodies (French ministry of higher education and research, French ministry of foreign affairs, CNRS, CEA, IFREMER, Météo-France (National Meteorological Service), TAAF (French Southern and Antarctic Lands), CNES (French Space Agency) and French Polar Expeditions). The mission of IPEV is to provide the legal framework and the human, technical and financial means for the development of French research in the polar regions. IPEV supports and implements national and international scientific programs, organises scientific expeditions and builds and maintains infrastructure and equipment in support of research. With 55 permanent members of staff, 30 contract employees for seasonal campaigns and an annual budget of 31.5 M€ (90% of which is dedicated to scientific, technologic and fieldwork activities), IPEV supports each year some 65 research programmes covering all disciplines. While a large proportion of these programmes are based on field activities in the southern polar regions, some are carried out in summer in Spitzbergen, in the Svalbard archipelago.

The CNRS is also involved in a wealth of research programmes focused on polar regions: 39 laboratories or joint research units are involved in scientific projects dealing with biology, ecology, geology, environment, climate, geophysics, astrophysics… Moreover, the *Groupement de Recherches Arctiques du CNRS* manages the French Spitzbergen stations and provides technical and logistic help. Some more specialized organizations have also been created such as the *Centre d'Etudes Arctiques*, an interdisciplinary research centre within the *Ecole des Hautes Etudes en Sciences Sociales*, or the *Centre de Recherches Inter-Nordiques*, carrying out research on the Saami and north Siberian people.

Some associations and non-governmental organisations also exist to bridge the gap between science and governance. The *Comité Français des Recherches Arctiques et Antarctiques* (CNFRA, French committee on Arctic and Antarctic research) for example, is an association which aim is to promote French scientific research in polar region, encourage international cooperation and represent France within the Scientific Committee on Antarctic Research (SCAR).

The *Cercle Polaire* is a non-governmental organisation which aim is to develop and promote a scientific understanding of the polar regions, and to encourage the preservation of the polar environments. To reach its aim, the focus of this NGO is on assessing the climatic, environmental, geopolitical and economic issues confronting the Arctic and the Antarctic and promoting the principles of international control and management of the polar environments, through the reinforcement of existing regulatory frameworks or the introduction of new regulations.

12.3 Governance

While France does not have any claim or inherent strategic economic interest in the Arctic, it does have a duty of involvement in case of a potential future Arctic crisis through its position as a Member State in the North Atlantic Treaty Organization (NATO) and the European Union [7]. According to the *North Atlantic Treaty of 1949* and by ratifying the *Lisbon Treaty* and the clause of mutual defence, France indeed agreed that if a Member State (Canada, Denmark, Norway or the United States of America) is the victim of armed aggression on its territory, other Member States shall have towards it an obligation of aid and assistance by all the means in their power. To that end, France has been involved over the years in the governance of the Arctic, mainly as an observer to the Arctic Council, but also as the instigator of the Arctic Governance Project.

Formally established by the *Ottawa Declaration* [3], the Arctic Council is a high level intergovernmental forum aimed at providing a means for promoting cooperation, coordination and interaction among the Arctic States, with the involvement of the Arctic indigenous communities on issues regarding sustainable development and environmental protection. Member States of the Arctic Council are the five neighbouring countries, Canada, Denmark (including Greenland and the Faroe Islands), Norway, the Russian Federation and the United States of America, plus Iceland, Finland and Sweden. In addition to the Member States, the Arctic Council has a category for Permanent Observers, amongst which France is represented.

The Barents Euro-Arctic Council (BEAC), the forum for intergovernmental cooperation in the Barents Region, established in 1993 in order to "provide impetus to existing cooperation and consider new initiatives and proposals", also recognises France as an observer.

Unlike the *Protocol on Environmental Protection to the Antarctic Treaty* [2], which designated Antarctica as a natural reserve devoted to peace and science and set up a moratorium on mining and drilling for oil for a minimum of 50 years, no such legislation currently governs the Arctic Ocean. The fundamental difference between both polar regions is the fact that more than four million people inhabit the coastal regions of the Arctic Ocean, and denying the exploitation of natural resources is neither realistic nor feasible. If various conventions or agreements, with bilateral or global scopes, can be enforced for issues arising in the Arctic Ocean, none has been specifically designed for that peculiar region of the world.

The most widely used legislation in the Arctic Ocean is the *United Nations Convention on the Law of the Sea* [5], which defines the territorial sea as the waters up to 12 nautical miles from the baseline, the Exclusive Economic Zone (EEZ) as the area adjacent and beyond the territorial sea and up to 200 nautical miles, and the continental shelf as the sea up to the fall of the continental shelf into the deep sea or at least up to the end of the EEZ. While the five Arctic circumpolar nations announced in their *Ilulissat Declaration* [1] that they were satisfied with the existing legal framework, one major problem with affirming that UNCLOS would govern the Arctic Ocean is that the United States of America are not a signatory to the Convention, and thus not constrained or governed by the same rules as the other signatories. Moreover, no mention is made of the rights of indigenous people and UNCLOS does not consider the major challenge represented by global warming.

In response to those issues, the Arctic Governance Project has been initiated in September 2007 by *Le Cercle Polaire*, within the context of a working group comprised of international experts in related fields. The Arctic Treaty proposal demonstrates the possibility of both a legal and theoretical reconciling of governance and sovereignty in the Arctic Ocean, without contradiction of, or infringement upon, current law. Used by French parliamentarians within the *Grenelle de l'Environment*, a conference held in France in fall 2007 bringing together the government, local authorities, trade unions, business and non-governmental organisations in order to define new actions for sustainable development, the Treaty directly inspired the European Parliament resolution on Arctic governance introduced by European parliamentarians and passed in October 2008. The creation of an international scientific observatory for the Arctic Ocean was also supported as a result of this conference.

12.4 Diplomacy

A French senate working group focusing on the study of the Arctic, Antarctic and the French Southern and Antarctic Lands, suggested the nomination of a French Ambassador aimed at representing the views of France on political, economic, cultural and scientific issues arising in the Arctic Ocean. The French scientific community, concerned by the lack of regulation in the Arctic, suggested the appointment of Michel Rocard, former Prime Minister. His pioneering role, alongside the Australian Prime Minister, in preventing the ratification of the *Convention on the Regulation of Antarctic Mineral Resource Activities* [8], leading to the above mentioned *Madrid Protocol* in 1991 and the subsequent protection of the Antarctic continent, led to his nomination as Ambassador of France for the international negotiations on the Arctic and the Antarctic on 18 March 2009. Since then, the former Prime Minister has been very active in representing France in various international conferences, and advocates the fact that despite France having no direct strategic interest in the Arctic Ocean, there is an enormous interest in maintaining safe commercial activities and military security in the region. While climate change and its dramatic effects on the environment and populations of the north polar region (pollution issues linked to industry and tourism, decrease of biodiversity and increase of invasive species, increase of population and migration patterns) is a reality and cannot currently be halted, diplomacy, be it political or scientific, has a crucial role to play.

12.5 Conclusion

The Arctic region has the potential to serve as an exemplary framework for shared dialogues between nations and it is more than ever acknowledged that a tremendous added value can be achieved when nations manage to envision their long term interests and the balance between their own interests and global ones. Scientific and political diplomacy, as well as the establishment of an international legal framework regulating activities in the Arctic Ocean, are the keys to maintaining a climate of peace and stability in this very severely climate change affected region. It is in every nation's interest to be aware of the dramatic effects of climate change and to reflect on the type of legacy they want to leave for the future generations, be it environmental or political. Whatever regulation will be enforced in the future in the Arctic region, the first and foremost concern however should be to make sure the interests of the four million people leaving in this fragile and still largely pristine ecosystem are preserved.

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Chapter 13
Observations on the Evolution of NATO's Science Programme*

James McQuaid

Abstract Since 1958, the North Atlantic Treaty Organization (NATO) has funded a programme of scientific activities with the aim of promoting conditions of stability and well-being. Under its current title of *Science for Peace and Security*, the programme has evolved from being entirely science-driven to having a closely-defined link with security in a broad sense. This paper traces this evolution and places the present Advanced Research Workshop in its evolutionary context, particularly in relation to the environmental security theme of the Workshop. The observations in the paper are addressed mainly to the scientific community and draw on the author's experience of the programme in a variety of roles.

13.1 Introduction

The *Science for Peace and Security* (SPS) programme of the North Atlantic Treaty Organization [1], under which this Advanced Research Workshop (ARW) was organised, has its provenance in a recommendation by a review in 1958 of the implementation of Article 2 of the original 1949 Treaty under which NATO was established. Article 2 makes explicit provision for NATO *'to contribute toward the further development of peaceful and friendly international relations…by promoting conditions of stability and well-being.'* The 1958 review was conducted by the Foreign Ministers of Norway, Canada and Italy. One thing that they recommended to be done as quickly as possible was the organisation of scientific cooperation,

*The views expressed are made entirely from a personal standpoint and do not in any way represent the policies or views of NATO.

J. McQuaid (✉)
Department of Mechanical Engineering, University of Sheffield,
Mappin Street, Sheffield S1 3JD, UK
e-mail: jim.mcquaid@live.co.uk

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a need already identified as urgent by US President Eisenhower and United Kingdom Prime Minister Macmillan in 1957. As a consequence, NATO established in 1958 a Science Committee and a modest programme to fund various mechanisms for promoting collaboration in science. This recognised the fact that science with its common goals and methods lends itself to collaboration across national boundaries and thus offered a means of contributing to peaceful dialogue and the breaking down of barriers to communication between nations, regarded as necessary preconditions for the achievement of stability and well-being.

The scientific character of the SPS programme has evolved since those beginnings. The programme has moved successively from using scientific collaboration solely in support of a public diplomacy agenda as originally envisaged, through supporting scientific collaboration on topics with potential spin-off security benefits, to an exclusive focus on scientific activities in support of closely-defined security priorities. Indeed, this changing policy emphasis has culminated in the current transfer of the programme, noted elsewhere in these proceedings, from NATO's Public Diplomacy Division to a new Emerging Security Challenges Division.

The Cambridge ARW, in its scope and composition, in my view represents an interesting consolidation of this evolution. The workshop was an overtly scientific forum but the science content not dominant. Rather the science served to inform a debate in which environmental security acted as an umbrella theme to a background of broad discussions on governance issues in the Arctic Ocean. This purposive integration of relevant science with real life characteristics of the situation at hand is quite different to the former style of intense interactions between specialists at the 'cutting edge' of a particular scientific topic, the defining terminology used throughout much of the programme's history. I believe that this context makes it an appropriate point to pause and for me, as an outside observer, to reflect and draw conclusions about the future of the programme as a scientific activity. This is especially so as NATO's longstanding involvement in the domain of civil science, still less the changing rationale for this involvement, are remarkably little known facets, in my experience, of the role of the organisation both inside and outside the scientific community.

13.2 Background History

My experience covers the whole of the programme's evolutionary spectrum. I had my first encounter with the programme at the 'intense interaction' stage at an International Technical Meeting organised 32 years ago by the Committee on the Challenges of Modern Society, now defunct but at that time a constituent committee of the Science Committee. I presented a scientific paper on what would now be called an environmental security topic but the debate was securely anchored on science with no diversion into security implications. This experience was refreshed in 2004 in presenting a paper at an ARW on Protection of Civilian Infrastructure from Acts of Terrorism though with the dominant scientific debate, not unnaturally, being leavened by the operational security implications. More recently, I participated in an

ARW on Energy and Environmental Challenges to Security when science and security shared equal prominence on the radar screen and the participants included representatives of many other interests besides science. Independently of these interactions, I acquired broader and firsthand experience of the scope and value of the programme through my participation in an advisory capacity as a member (later chairman) of the Environmental Security Panel of the committee charged with the scientific assessment of grant applications. This in turn led to an invitation to participate in a strategic review of the scientific orientation of the programme in the light of changing policy needs. I also have a continuing role in reviewing progress on a variety of research projects. Overall, this extended experience of the programme enables me to stand back and to offer these observations as a contribution to understanding in the science community.

13.3 Evolution of the Programme

Throughout much of its history, the focus of the Science programme was entirely on science topics and these did not have to be restricted in specification to identified NATO interests. The quality of the science alone was what mattered. NATO civil science activities attracted the top scientists. For many of them, an overt military agenda would have been a turn-off. And for many in the science community, a NATO badge alone was sufficient as a barrier to participation. Nonetheless, anecdotal evidence that I have received coupled with my own experience shows that the NATO-supported activities, in particular the format of ARWs, were viewed by participating scientists as 'best in class', conducive to fruitful interchange to a degree well in excess of the conventional scientific gathering. They produced useful scientific outcomes in terms of shared perspectives on the 'state of the science' and future directions for research.

In the middle years, the primary objective was to promote the development of science and technology in NATO countries as a balance to the developing technologies of the Warsaw Pact countries. Since the early 1990s, the programme has been especially targeting NATO Partner countries (those not in the military alliance) and more recently the Mediterranean Dialogue countries. A concomitant change was that programme activities were required to have co-directors from both a NATO and a Partner country. Although a broad alignment of programme activities with NATO and Partner priorities became increasingly necessary, the programme composition was still largely decided on the basis of the scientific excellence of proposals as judged by independent peer review. Hence the orientation of the programme was said in the jargon to be the result of a 'bottom up' decision process.

This orientation changed progressively. A move in the early years of the millennium resulted in a change in title from *Science* to *'Security through Science.'* Security was interpreted broadly, including an explicit recognition of conditions of living that allow development and well-being of all citizens. This resonated with one of the three grand challenges for the twenty-first century identified in the *Millennium Report to the United Nations General Assembly* as *"the freedom of future generations* *to sustain their lives on this planet"* [2]. The NATO objectives for the programme therefore included one on *"other threats to security"* [3]. This captures environmental security as a component and hence leads to the NATO support provided for the present ARW.

A 'top down' orientation was introduced to enable NATO security objectives and Partner priorities to be more firmly impressed on the programme composition, complementing though not displacing the drivers coming from bottom up. The title was changed again in 2006 to the present *Science for Peace and Security* [4]. A recent reorganisation, as described elsewhere in these proceedings, has seen the SPS programme retained but with decision making on proposals elevated in the hierarchy and subject to assurance from peer review as to the relevance and soundness of the science in a proposal to achievement of a security objective rather than an innate and somewhat ill-defined 'excellence'. This I believe to be entirely consistent with the changed fundamentals of the programme, from a focus on excellence per se to a focus on the actual desired outcomes, a change that mirrors what has been happening elsewhere for many years in scientific support programmes as distinct from open-ended research programmes.

13.4 Environmental Security

It is at this point that I return to my belief that the present ARW represents a consolidation of the evolution of the SPS programme, as described. The Workshop is, I suggest, the exemplar of a style that seems entirely in keeping with the current NATO policy of requiring a firm link with security but allowing of a broad definition of security. Media reports about the implications of an ice-free Arctic Ocean are generally pitched to give rise to a fear that the area is on the verge of serious conflict, a view that was strongly and authoritatively disputed at the Workshop. Given this, the aspect of security immediately relevant to the Workshop, and made overt in its badging, is clearly that of environmental security as an interest held in common across national boundaries. Professor Berkman in his scene-setting address to this workshop defined environmental security as *'an integrated approach for assessing and responding to the risks as well as the opportunities generated by environmental state-change.'* He further stated that *'broad governance discussions are premature without an holistic vetting of the risks.'* The necessity for such an holistic approach was also emphasised by remarks of the UK Foreign Secretary Margaret Beckett in 2006 in relation to climate change in general: *'This is not just an environmental problem. It is a defence problem. It is a problem for those who deal with economics and development, conflict prevention, agriculture, finance, housing, transport, innovation, trade and health.'*

It is pertinent to compare those perspectives with the prevalent understanding in the science community of the rationale for NATO support of science, qualified though it is as being 'for peace and security'. The SPS programme, particularly in its presentation of the environmental security issue, does take (or at least gives encouragement to) a reductionist (as opposed to holistic) stance, illustrating the issue by a listing of individual environmental problems – management of water and non-renewable resources, desertification, land erosion, sustainable development, disposal of dangerous chemicals and pesticides, disaster forecast and prevention of natural catastrophes. These problem areas tend, in my experience, to be regarded as self-contained for the purpose of framing grant applications and thus the preserve of corresponding specialist scientific institutes and university departments in many of the Partner and Mediterranean Dialogue countries that have in the main been the clients for the SPS programme in the past. This feature may result in a persistence of the bottom-up approach at the client level or, perhaps more likely, that there will be confusion amongst the community of clients on how to accommodate to the top-down orientation with the attendant risk of a loss of interest in the programme. Avoidance of reductionism is, of course, important because of the risk of unintended consequences arising in situations where complex interactions exist, as the Workshop showed to be the case in the Arctic Ocean. There is therefore a need, I suggest, for communication and education in order to embed the holistic nature of environmental security into the thinking of the scientific community in those countries, with the aim of encouraging the engagement of an integrated and expanded community in the submission of proposals. The Cambridge Workshop fully met this aim and could be taken as pointing the way for the future. Although environmental security is indeed a quintessentially holistic concept, nonetheless the above remarks could also apply to other NATO strategic objectives for the SPS programme.

13.5 Conclusion

The Cambridge ARW has provided valuable experience of how the SPS programme can adjust fruitfully to the current policy imperatives of NATO especially in the area of environmental security. The lessons may take time and the application of effort if they are to be diffused through the scientific community. There will still be room for a sole focus on vertical integration in those non-complex cases where the scientific problems are self-contained within a discipline and the assessment of the security implications provided from bottom up assuredly meets the strategic objective driven from top down. However, such cases in the area of environmental security are the exception and thus the experience of the Cambridge ARW could prove to have a wider educational value for future participants in the programme.

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Chapter 14
Arctic Futures: The Power of Ideas

Oran R. Young

Abstract That the Arctic is experiencing transformative change is no longer news. But what are the implications of this development with regard to matters of governance and policy? This article makes the case that the answer to this question depends on the paradigm or discourse we employ as a conceptual framework for interpreting the meaning and significance of changes in the circumpolar Arctic. It contrasts interpretations produced by observers whose thinking is rooted in the neo-realist/geopolitical paradigm with those offered by others whose thinking rests on a socio-ecological systems paradigm. Although journalists and popular writers tend to gravitate toward the neo-realist/geopolitical paradigm, those who possess a more intimate knowledge of recent developments in the Arctic are inclined to base their thinking on the socio-ecological systems paradigm. Because the assumptions and precepts of paradigms or discourses are not falsifiable, it is fruitless to try to demonstrate that one of the two paradigms is somehow superior to the other. Nevertheless, for those dedicated to preserving the Arctic as a zone of peace, the socio-ecological systems paradigm has strong attractions.

14.1 Introduction

That the Arctic is undergoing a dramatic transformation, driven by the interacting forces of climate change and globalization, is no longer news. The media have disseminated a steady stream of iconic images of the changing Arctic depicting such things as the recession and thinning of sea ice in the Arctic Basin, the opening of the

O.R. Young (✉)
Institutional and International Governance, Bren School of Environmental Science and Management, University of California, Santa Barbara, CA 93106, USA
e-mail: young@bren.ucsb.edu

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Northern Sea Route and the Northwest Passage during the summer months, the melting of portions of the Greenland ice cap, and the plight of polar bears stranded on disintegrating ice floes. Projections of continuing change, featuring extraordinary developments like a seasonally ice-free Arctic Ocean, are now widespread. But what does all this mean in human terms, and how should we organize our thinking about the implications of this transformation for policy and governance? Must we brace ourselves for the onset of a new cold war, an Arctic "great game," or a sequence of increasingly severe resource wars, as many popular writers on Arctic issues are suggesting? Or are there prospects for more cooperative relationships developing in the circumpolar Arctic and making the region an exemplar for those striving to respond constructively to rapid biophysical and socioeconomic changes occurring in other regions? Might the Arctic even emerge as a showcase for new forms of transnational cooperation in an era in which a variety of non-state actors are assuming increasingly prominent roles, even though states will remain important actors, in a more complex global system?

This article addresses these questions in several steps. The first substantive section explores the nature of the changes now unfolding in the Arctic. It singles out characteristics of these changes that are particularly important from the perspective of creating or adjusting governance systems that are able to meet emerging needs for governance in the far North. The next section turns to the theme of framing. Noting that the facts never speak for themselves, it comments on the roles of paradigms, discourses, or conceptual frameworks in shaping our thinking about situations featuring rapid change and high levels of uncertainty. The following section turns to the striking tendency of observers to look upon the changing Arctic through the lenses of neo-realism, realpolitik, and geopolitics. It directs attention to the gap between this conceptual framework and what is actually going on in the Arctic today. The penultimate section introduces the idea of complex and dynamic socio-ecological systems as an alternative frame of reference for thinking about Arctic affairs. It suggests that this alternative is appealing not only because it provides a better account of what is actually happening in the Arctic but also because it leads to policy prescriptions designed to promote peace and international cooperation in this dynamic region. The final section brings the discussion back to the fundamentals of framing and offers some thoughts about ways forward in addressing emerging Arctic issues. In the end, it recommends a course of action that admittedly rests on a normative preference but that deserves serious consideration in the light of the analysis presented in the body of the article.

14.2 The Changing Arctic

To say that Arctic sea ice is receding and thinning, that the active layer of the permafrost in the circumpolar Arctic is becoming deeper, that habitat changes may threaten the survival of polar bears, and that the Northern Sea Route is becoming more accessible to commercial shipping is to point to prominent occurrences that may present either opportunities or challenges from the point of view of human interests in the resources of the region. But by themselves these observations do not point to underlying features or characteristics of change that need to be considered in efforts to think through needs for governance arising in the Arctic today and during the foreseeable future. To address this issue, we need to get beneath the surface and to identify those characteristics of change that will determine the nature of the policies needed to address the transformation we are witnessing today. The set of characteristics of this sort is not fixed; more may surface as we endeavor to come to grips with the changing Arctic. But three prominent features of the changes occurring in the Arctic come into focus as we approach this development in analytic terms.

The changes occurring in the Arctic today are systemic, non-linear, rapid, and irreversible on any human timescale. Most obvious in this connection are the cases of sea ice, where the change in seasonal minima in recent years is unprecedented, and tundra ecosystems, where shifts from sink to source with regard to emissions of greenhouse gases (GHG) are occurring throughout the region. Non-linearity is fast becoming a common feature of change in the Arctic. Not only are these changes irreversible in the sense that there is no prospect of conditions reverting to the status quo ante during the foreseeable future; they are also systemic in the sense that they involve suites of changes that interact with one another to produce powerful feedback effects and trigger alterations that are far-reaching in character. To take a single example, the melting of sea ice leaves open water, thereby lowering the albedo of the Arctic and accelerating the rate at which remaining ice melts. The result is that the Arctic is experiencing what scientists often call a state change, leading to what more popular writers have described as a "new" Arctic [2]. Whatever terms we use to describe this cluster of features of change, one thing is clear. We cannot count on existing governance systems to address the raft of pressing issues now arising in the Arctic [1]. At a minimum, we will need arrangements capable of providing early warning regarding tipping points leading to abrupt and dramatic changes and of adjusting in a nimble and efficient manner to deal with changing circumstances. More generally, these developments raise fundamental questions about the adequacy of the ponderous system of interstate diplomacy that we have relied on traditionally to address issues that are too big to be handled within the domestic arenas of individual nation states.

Another prominent characteristic of the changes now occurring in the Arctic is the extent to which they tighten the links between what happens in the circumpolar Arctic and developments taking place at the global level. Both major drivers of Arctic transformation, climate change and globalization, are consequences of human actions that are occurring, for the most part, outside the Arctic and that are difficult or impossible to regulate on a regional scale. The Arctic itself is a minor source of GHG emissions. Yet the impacts of climate change are unfolding both sooner and in more dramatic forms in the high latitudes of the northern hemisphere than elsewhere. Pressures to exploit recoverable reserves of oil and gas in the Arctic and to open up Arctic routes to commercial shipping emanate from the needs of industrial systems located well to the south of the circumpolar Arctic. The contrast between this feature of change in the Arctic and the recent past is striking. Though the Arctic was never cut off from the outside world, the period following the end of the cold war and preceding the onset of climate change was a time in which it was easier to focus on Arctic issues without becoming preoccupied with the links between the Arctic and the outside world. Both the launching of the *Arctic Environmental Protection Strategy* [4] and the creation of the Arctic Council [25] owe much to the dynamics of this period. Now, we are in a new world with respect to the region's policy agenda. Whether we like it or not, there is no way to come to terms with the issues arising in the Arctic today without enlisting major non-Arctic emitters of GHGs (e.g. China, the European Union, India) and non-Arctic users of hydrocarbons and major trading states (e.g. China, Japan, Korea). All this means that an inward-looking strategy that seeks to address Arctic issues while building barriers to the participation of non-Arctic states and other actors cannot succeed in today's environment.

Beyond this lies the pervasiveness of uncertainty. There are many things that we do not know and cannot predict with confidence at this stage. Clearly, this applies to climate change and to the biophysical impacts of climate change. There is no point in pretending that we know such things as when the Arctic Basin will be ice free in the summer, the future pace of melting of the Greenland ice cap, the likelihood of large methane releases from tundra ecosystems, or the probability of rapid melting of methane hydrates in shallow Arctic seas. But uncertainty extends to a range of economic, political, and social matters as well. We do not know, for example, whether technological innovations will reduce the global demand for hydrocarbons, how strenuously non-Arctic states (e.g. China and the European Union) will assert their interests in the Arctic, whether non-state actors will become increasingly potent players in Arctic affairs, and so forth. There is nothing uncommon about the presence of uncertainty regarding prominent issues on policy agendas; it is a rare case in which we can anticipate the costs and benefits of different policy options with sufficient precision to make it possible to calculate benefit/cost ratios for alternatives available to address specific issues on policy agendas with confidence. But levels of uncertainty are particularly high when it comes to weighing the pros and cons of different responses to issues now arising in the Arctic, and we can expect influential players to adopt radically different stances regarding both the extent of uncertainty and how to cope with it in the context of specific issues. It is hardly surprising, for instance, that major oil companies (e.g. Shell or Statoil) take a different view than leading environmental organizations (e.g. World Wildlife Fund) of the likelihood of major oil spills under Arctic conditions and of the impacts of oil spills under such conditions in the event that they do occur. No strategy for meeting governance needs in the Arctic during the next several decades can succeed without devising some procedures for sorting out issues of this sort and arriving at policy choices that have some measure of legitimacy in the eyes of key stakeholders.

14.3 Arctic Paradigms

How can we cope with this situation in which dramatic changes are coupled with a high level of uncertainty as we seek to address specific issues arising in the Arctic and, more generally, to put in place governance systems that are capable of responding appropriately to a range of issues likely to arise in the coming years? As many analysts (and not just those who regard themselves as constructivists) have observed, those required to make choices under such conditions create mental maps that make it possible to interpret developments occurring in the real world and to steer thinking about what would otherwise seem like a bewildering array of developments exhibiting no discernible pattern [20]. Whether we call these mental maps paradigms, discourses, or simply conceptual frameworks, these constructs allow observers to make sense of the world by laying down fundamental premises (e.g. international society is a society of states), articulating behavioral assumptions (e.g. states are driven first and foremost by a concern with security in the material sense), and propositions about the nature of effective policies in such a setting (e.g. promoting a balance of power is a means to secure peace). A particularly striking feature of these paradigms is that their core elements are not subject to confirmation or falsification through the use of ordinary empirical procedures. This does not mean that prevailing paradigms are entirely impervious to reasoned assessment or that we cannot trace the rise and fall of dominant paradigms over the course of time. For several decades now, for instance, there has been a lively debate about the fate of the nation state and the extent to which it makes sense to cling to the premise that international society is fundamentally a society of states. But as this example suggests, such debates are seldom resolved through conventional procedures featuring the collection and assessment of empirical evidence.

It is easy to see that the paradigm we adopt will affect profoundly how we think about the changing Arctic, what needs for governance are likely to arise as we seek to adjust to these changes in the near future, and what it will take to meet these needs for governance. Those who think in terms of a new cold war or the onset of resource wars in the Arctic, for example, typically assume that states are the dominant actors in this arena, that these actors will compete with one another for control of scarce resources (e.g. hydrocarbons), and that this competition will lead to increasingly severe conflicts and quite possibly armed clashes in the not so distant future. Proponents of this way of thinking will treat the Arctic as an arena for "high politics" and take it for granted that to be effective governance systems must pay close attention to monitoring changes in the political initiatives of the individual Arctic states and preserving a balance of power in the region. They are apt to assume that the key to the future of the Arctic will lie in developing and maintaining at least a rough balance between Russia and the rest of the Arctic coastal states [8].

Nonetheless, this is not the only way to organize our thinking about the implications of the state change unfolding in the Arctic today. It is striking, for example, that Mikhail Gorbachev took the lead in 1987 in calling for the development of the Arctic as a *"zone of peace and cooperation"* [14], that Vladimir Putin reiterated this vision in 2010 [27], and that Russia has been scrupulous in adhering to legal requirements regarding matters like the delimitation of jurisdiction over the continental shelves lying beyond the outer boundaries of the EEZs of the Arctic coastal states. As others have pointed out, there are no serious disputes in the Arctic regarding territorial boundaries, and states are taking effective steps to resolve disputes regarding maritime boundaries [9]. The *Norway-Russia Treaty* [23] regarding jurisdictional boundaries in the Barents Sea is a striking example, and there are reasons to believe that other agreements of this sort will emerge in the foreseeable future. If actions speak louder than words, the Arctic may well become an exemplar of constructive ways to address issues arising from the impacts of climate change and globalization in the coming years.

Taking these observations as a point of departure, I turn now to an account of the paradigm that is implicit if not explicit in the works of most popular writers and journalists interested in the Arctic, the reasons for the tenacity of this paradigm, and the main features of an alternative paradigm that has much to recommend it as a way to organize our thinking about the future of the Arctic. The former I describe as a neo-realist/geopolitical paradigm; the latter I characterize as a socio-ecological systems paradigm. It follows from what I have said in this section that there is no way to show conclusively that one of these paradigms is correct and that the other should be discarded. Rather, I seek to: (i) explain why the neo-realist/geopolitical paradigm is so influential in this setting; (ii) raise questions about the extent to which this paradigm is useful as a guide to policymaking in the "new" Arctic; and (iii) articulate the main elements of an alternative socio-ecological systems paradigm.

14.4 The Neo-Realist/Geopolitical Paradigm

With few exceptions, popular writers and journalists cast their interpretations of current and expected future developments in the Arctic in the language of neo-realism and geopolitics [12,13,16,28]. Assuming that nation states are still the main players on the international stage, they anticipate the onset of jurisdictional battles and draw attention to the question of "who owns the Arctic?" [9]. Impressed with the geopolitics of energy on a global scale, they speak of an *"Arctic gold rush"* and lead us to believe that a series of increasingly severe "resource wars" are in store for the Arctic [16]. Attuned to the deployment of military forces as a prominent indicator of shifts in the political landscape, they note recent Russian exercises involving the operation of manned bombers and naval vessels in the Arctic and jump to the conclusion that a new *"cold war"* is ramping up in the circumpolar Arctic. Harking back to the convoluted politics of Central Asia during the nineteenth century, they even surmise that we are witnessing the early phases of a new "great game" in the Arctic that will make clashes between Russia and the United States all but inevitable during the coming years [7]. Some even anticipate an "Arctic meltdown" [6] leading to *"… brutal, bitter and bloody confrontations waged between rival international powers that are desperate to acquire the world's diminishing supply of natural resources"* ([16]: 10). On this account, the Arctic is on its way to becoming a critical battleground on which the great powers are likely to engage in an intense contest that will shape the geopolitical foundation of the world order of the twenty-first century.

What makes this characterization of the changes unfolding in the Arctic particularly remarkable is that it flies in the face of most of the evidence regarding what is actually going on in the Arctic today and that there is an inverse relationship between knowledge of Arctic affairs and the adoption of neo-realist perspectives. In those limited areas where jurisdictional differences are significant in the Arctic, the relevant actors are either taking steps to resolve these differences peacefully, as in the case of the Norwegian/Russian agreement regarding maritime boundaries in the Barents Sea, or proceeding to address the issues through the procedures prescribed under the terms of the *United Nations Convention on the Law of the Sea* [33], as in the case of the treatment of claims to extended jurisdiction over the Arctic's continental shelves under the terms of Article 76 of the UNCLOS. Largescale resource development, especially in the cases of oil and natural gas, will occur during the foreseeable future largely in areas already under the jurisdiction of the Arctic coastal states; such activities will not ignite resource wars, though they may have some impact on global energy markets. The Arctic states have reached an agreement on search and rescue [3] regarding the provision of assistance to ships in distress. More generally, interested parties are making progress toward the adoption of a mandatory Polar Code to govern the construction and operation of ships plying Arctic waters.

Even the popular writers and journalists, who use dramatic images of resource wars and violent clashes in the Arctic to draw attention to their work, tend to arrive at more sober conclusions after they have examined the evidence regarding actual developments in the Arctic. The author who spoke of the prospect of a *"… brutal, bitter and bloody confrontation"* in the Arctic, for example, concludes *that "… this scenario is even less likely to happen in the Arctic than elsewhere"* [16] and that *"… governments are most unlikely to want to risk losing a war over an area that may have nothing … to offer them"* [16]. The author of another popular account concludes that *"… the North Pole [is not] going to be the setting for a new kind of Cold War – much as it might make for an easy headline"* [13]. The author of a book entitled "Who Owns the Arctic?" ends by arguing that the Arctic is a promising region for those seeking to encourage international cooperation, because it is *"… a vast, sparsely populated region with only a handful of nation-states; only a few, relatively minor boundary disputes; and a pre-existing framework of universally accepted international rules, centrally including the law of the sea"* [9].

So, what is going on here? Why is the neo-realist discourse so attractive to popular writers and journalists attempting to explain the transformation taking place in the circumpolar Arctic to a broader public? There are bits and pieces of evidence that lend some credence to a neo-realist account, especially when taken out of context. Although the Russians have forcefully and repeatedly denied it, those who view the world through a neo-realist lens have tended to treat the planting of a Russian flag on the seabed at the North Pole in August 2007 as *"… part of a carefully planned operation to assert Russia's claim over part of a region that seemed to belong to no one"* ([16]: 3). Some observers attach great importance to the rebuilding of the Russian Northern Fleet based on the Kola Peninsula [17], despite the fact that this is almost certainly a more general initiative designed to reassert Russia's claim to great power status at a global level in contrast to an effort to adopt an aggressive stance regarding the Arctic. The bluster of Canada's prime minister in asserting that his country must adopt a policy of "use it or lose it" in dealing with the Arctic and, as a result, step up Canada's military presence in the far North seems provocative and even destabilizing to some. Both Russia and the United States have adopted reformulated Arctic policies that can be read as raising Arctic affairs to the level of high politics in their thinking about emerging global issues.

Still, these bits and pieces of evidence add up to a pretty thin argument in support of the resource wars, new cold war, great game perspective on the transformation occurring in the Arctic. Several other considerations go a long way toward explaining the power of the neo-realist rhetoric in this setting. Not only is this interpretation easy to grasp in the absence of a sophisticated understanding of Arctic issues; it is also deeply embedded in the popular imagination shaped by the events of World War II and the cold war that followed. Through a sizable chunk of this era, after all, the Arctic was divided into two armed camps with the Soviet Union on one side and the United States and its NATO allies on the other [24]. The resultant fragmented perspective on the circumpolar Arctic dies hard in the thinking of many. Add to this fertile ground the fact that provocative images make headlines that have the punch needed to capture public attention. Imagine as a thought experiment a situation in which a raft of new books and articles about the changing Arctic were to refer to the region as an emerging *"zone of peace and cooperation"* or as an arena featuring interesting experiments involving innovative procedures for recognizing the role of non-state actors like indigenous peoples' organizations. There is little likelihood that any framing of this sort would persuade the editors of a publication like *Time* magazine to run a cover story on developments occurring in the circumpolar Arctic [30].

Equally important, in my judgment, is the absence of a well-developed alternative paradigm that provides a different but equally coherent perspective on the changing Arctic, that is forward looking rather than backward looking, and that brings into focus a twenty-first century Arctic agenda in contrast to a twentieth century agenda. Unless and until such an alternative paradigm emerges, the simplistic but in many ways appealing neo-realist paradigm is likely to dominate the framing of Arctic issues and, in the process, control the agenda with regard to the treatment of Arctic issues in major policy venues. What form might such an alternative paradigm take? It follows from what I have said in earlier sections of this article that there is no correct answer to this question. Nonetheless, it is both possible and pertinent to think hard about this question as we seek to formulate a twenty-first century governance system for the Arctic.

14.5 The Socio-ecological System Paradigm

The transformation occurring in the Arctic today constitutes the leading edge of a set of developments that are global in scope. Increasingly, we find ourselves living in a world of human-dominated ecosystems in which largescale biophysical processes interact with equally largescale socioeconomic processes to give rise to complex and dynamic systems characterized by changes that are non-linear, rapid, and frequently irreversible [31]. The need for governance looms large in such settings, which pose multiple challenges that do not lend themselves well to standard approaches to governance (e.g. the negotiation of formal multilateral agreements) that still dominate efforts to solve problems in international society. Nowhere are these conditions, symbolized by the concept of the Anthropocene [11], more prominent than they are in the Arctic. If we can find workable procedures for solving – or at least managing – the resultant policy problems in the Arctic, the results will be of interest not only to those with a specialized interest in the far North but also to a wide range of practitioners and scholars interested in global governance in more general terms. For purposes of discussion, I label this analytic framework the socio-ecological system (SES) paradigm and explore its usefulness in understanding both the transformation now occurring in the Arctic and the policy agenda flowing from this transformation.

At the heart of the SES paradigm lies the idea of systems and more specifically systems that are complex and dynamic. As those who strive to understand the nature of ecosystems, economic systems, information systems, social systems, and even the world system know, a system is "… an interconnected set of elements that is coherently organized in a way that achieves something" ([22]: 11). Those who wish to understand systems and to devise effective policies relating to systems must go beyond a concern with the elements of the systems of interest to focus on the systems themselves as units of analysis and to develop ways of thinking about the "behavior" of these systems. To understand the nature of the solar system, for instance, it is not enough to ask questions about the sun and the various planets as elements of the system; it is the behavior of the system as a whole that becomes a central focus of attention. Much the same is true of efforts to understand other systems. Ecosystems are not just collections of distinct species, and social systems are not just collections of individuals and organizations. They all lend themselves to analysis at the system level and to the development of systems theories.

In thinking about the Arctic, it is essential to start with the observation that we are dealing here with what has become known as a socio-ecological system [15,32]. The behavior of such systems is driven both by biophysical forces and by the actions of human beings. Although human actions have long been significant on a small scale, we have embarked in recent times on an era in which anthropogenic forces rival and, in some instances, exceed the impacts of biophysical forces on a large scale. Nowhere is this phenomenon of human-dominated systems more in evidence than in the circumpolar Arctic today. Both climate change and globalization, the major drivers of transformation in the Arctic, are largely anthropogenic in character. It follows that any effort to understand what is going on in the Arctic today must direct attention to the sources of the relevant human actions and that initiatives aimed at managing or guiding the course of this transformation must devote sustained attention to prospects for influencing the future trajectory of these actions.

In using the SES paradigm as a conceptual tool for thinking about current and projected developments in the Arctic, it makes sense to introduce at an early stage the idea of nested systems. It is useful for some purposes to treat the circumpolar Arctic as a system in its own right. It has distinctive biophysical features as well as a set of social practices (e.g. the activities of the Arctic Council) that are organized in Arctic-specific terms. Nonetheless, it is easy to see that the Arctic system is nested within a global system whose behavior has profound consequences for the future of the Arctic. The impacts of climate change in the Arctic are attributable, in large measure, to actions occurring well beyond the boundaries of the Arctic as defined in any familiar way. Pressures to exploit the natural resources of the Arctic arise from the voracious needs for natural resources of industrialized societies located around the world. It is apparent, therefore, that we cannot address needs for Arctic governance effectively without finding ways to include outside actors in the process. Yet, it would be an unwelcome and regressive step to allow outside forces to dominate the future of the Arctic through a reemergence of the core/periphery relationships that have loomed large in the history of the far North. What is needed, on this account, is a form of multilevel governance in which the flow of influence is bi-directional allowing Arctic concerns to play a role at a global scale as well as vice versa [29].

The SES paradigm also directs attention to the dynamic character of the Arctic. All complex systems are dynamic in the sense that change occurs on a continuous basis and that more dramatic changes of the sort often referred to as state changes occur from time to time. But the addition of the human dimension in SESs heightens the role of changes that are non-linear, rapid, irreversible, and sometimes nasty from the perspective of human welfare. Human behavior is reflexive, and this feature of SESs makes it possible for humans to react to changes and even to anticipate changes in ways that stabilize important processes and dampen processes likely to trigger state changes. But reflexivity is a two-edged sword. It can lead to positive feedback processes in such forms as stock market crashes or the acceleration of losses of sea ice as well as to negative feedback processes in such forms as countercyclical economic policies or the planting of trees to capture carbon dioxide in the atmosphere. As the discussion of the changing Arctic in an earlier section suggests, there is good reason to believe that we are experiencing non-linear, rapid, and irreversible changes in the Arctic at this time. From a governance perspective, this suggests that there is an urgent need for the creation of early warning systems, the establishment of mechanisms that allow the Arctic states to respond to these changes in a coordinated manner, and the development of procedures that enhance rapid response capabilities.

The adoption of the SES paradigm has major implications for the issues of governance arising in connection with the transformative change occurring in the Arctic today. In substantive terms, the SES paradigm directs attention to holistic concerns and the policies needed to respond to these concerns, like ecosystem-based management (EBM) and place-based management [21]. and effective measures to integrate the insights of western scientific knowledge and various forms of traditional ecological knowledge [5]. It also emphasizes the importance of thinking in terms of the behavior of largescale systems and the role of feedback processes that can either help to control runaway processes or to fuel such processes in a manner that makes it difficult or impossible to regain the capacity to control or at least to steer them once they are underway. One important insight that arises from this way of thinking focuses on the linkages between efforts to maintain ecological integrity in such forms as the protection of biological diversity and to sustain cultural integrity in such forms as the protection of subsistence practices and longstanding patterns of human-environment interactions [26]. Humans who interact directly with biophysical systems tend not only to understand the behavior of ecosystems but also to place a high value on keeping these systems intact. Conversely, those who make decisions in distant boardrooms often show little if any concern about the impacts of their actions on natural systems. One way to capture this train of thought is to make use of the concept of stewardship as it has evolved from traditional practices through ideas like Aldo Leopold's land ethic and on into current thinking about the role of stewardship in maintaining the integrity of socio-ecological systems [10,19]. The good news is that in the Arctic today the foundations of this way of thinking are intact. It remains to adopt policies and practices (e.g. applied forms of EBM) that can nurture practices based on stewardship and integrate them into a range of governance arrangements designed to fit the circumstances of the Arctic.

In terms of process, the way forward in the Arctic, on this account, is to encourage the development of a governance complex in the sense of a collection of issue-specific regimes that are able to function individually but that are also sufficiently interconnected to form a system that is flexible in meeting a range of different needs for governance and that is adaptable in responding to changes in these needs over time [18]. Some elements of this governance complex (e.g. the framework set forth in the UNCLOS) are already in place; others (e.g. collaborative arrangements dealing with search and rescue, a mandatory Polar Code) are now coming into focus. Still others (e.g. a stringent code of conduct designed to avoid oil spills under Arctic conditions) are somewhat farther off at this stage. Yet the overall message to be derived from the adoption of the SES paradigm in thinking about the future of the Arctic is clear. We must find ways to maintain a clear focus on systemic concerns even as we move forward with specific arrangements addressing matters like commercial shipping and oil and gas development and take advantage of opportunities to create multi-level governance arrangements that foster a two-way flow between global processes (e.g. the effort to address climate change on a global scale) and Arctic-specific processes (e.g. the effort to strengthen the Arctic Council to serve as an advocate for the concerns of Arctic actors in various global venues).

14.6 The Way Forward

Given what I have said about the nature of paradigms or discourses and the differences between the perspectives of the neo-realist/geopolitical and the SES paradigms as frameworks for thinking about Arctic affairs, how should we proceed? There is no point in attempting to prove that one of these paradigms is correct and that the other is incorrect. Conceptual frameworks of this sort are non-falsifiable. Partly, this is a matter of the assumptions about the motivations of key actors embedded in these paradigms. Those who adopt the neo-realist paradigm, for instance, will interpret the planting of the Russian flag on the seabed at the North Pole in 2007 and the renewed flights of Russian bombers over the Arctic Basin as matters of power politics, regardless of evidence to the contrary. Similarly, they will discount Vladimir Putin's recent statement about the importance of maintaining the Arctic as a "zone of peace" as nothing but political rhetoric, despite its compatibility with numerous other Russian statements about the Arctic. In part, the non-falsifiability of such paradigms arises from the fact that they are future oriented. To continue with the same example, those who espouse the neo-realist paradigm will assert that the Russians are just waiting for an opportune moment to engage in a show of force in the Arctic; the fact that they have not done so already is simply a matter of diverting the attention of others from the implementation of this strategy. Similar comments are in order about the behavior of other actors interested in the Arctic and about the vision embedded in the SES paradigm. It follows that it is a waste of time to argue about the validity of these conceptual frameworks.

Nevertheless, the implications of adopting one of these paradigms or the other for the future of the Arctic are profound. For one thing, the two paradigms have huge consequences for the framing and prioritization of major issues on the Arctic policy agenda. From a neo-realist perspective, top priorities include addressing jurisdictional disputes (e.g. the legal status of the Northwest Passage), maintaining sovereign control over areas in the Arctic lying within national spheres of jurisdiction, and responding promptly to any seemingly aggressive moves on the part of others. The attitude embedded in Stephen Harper's doctrine of "use it or loss it" as a cornerstone of Canada's Arctic policy exemplifies this perspective. By contrast, policy priorities associated with the SES paradigm center on regulating the extraction of natural resources and commercial shipping in the Arctic, adopting a precautionary stance designed to avoid serious oil spills under Arctic conditions, and, more generally, applying the idea of ecosystem-based management to the circumpolar Arctic. Recurrent calls for the development of new, more encompassing governance arrangements characterize this way of thinking.

Both paradigms call for the development of global perspectives on Arctic affairs. But the similarity stops there. Neo-realists point to worldwide shifts in the geopolitical underpinnings of international society, increasing competition over the control of scarce natural resources, and the reemergence of cold war tactics. Those adhering to the SES paradigm, by contrast, focus on the role of the Arctic in the dynamics of climate change and on the prospect that the exploitation of the Arctic's hydrocarbons will diminish incentives to begin the transition toward a green economy. This contrast has important implications for the identification of key players in the domain of Arctic policy. The neo-realist paradigm, with its emphasis on national security, suggests that we must accept foreign ministries backed by defense establishments as the major players in all efforts to address matters of policy in the Arctic. The SES paradigm, with its emphasis on stewardship, suggests a different view of the policy process in which environment ministries, agencies responsible for land/sea management, and a range of non-state actors including indigenous peoples' organizations become leading players in dealing with Arctic policy issues. The two paradigms are apt to be self-reinforcing, strengthening the case that Arctic affairs should be dominated at the end of the day by officials and other actors who can be counted on to look at the world through the relevant lenses.

Does this land us in a political cull-du-sac? The easy way out is to sign off at this point with the comment that any choice between paradigms is a matter of normative preferences rather than rigorous analysis and must therefore be handled through political processes. In thinking about the future of the Arctic, however, this strategy strikes me as unsatisfactory. As I see it, we stand today at an historic turning point at which rapid change in the Arctic may reinforce the neo-realist focus on issues of security or invigorate the emphasis of the SES paradigm on matters of stewardship. In my judgment, the SES paradigm offers a perspective on Arctic affairs that is preferable to the neo-realist paradigm on normative grounds. I believe as well that those of us who have a long-standing engagement in Arctic affairs have a moral responsibility to play a role in tipping the balance toward the SES paradigm as a way of framing and prioritizing the Arctic's policy agenda. Neo-realists may regard this line of thinking as naïve in the sense that it could leave the Arctic open to exploitation on the part of those who think in geopolitical terms and strive at all times to gain the upper hand with regard to the distribution of influence. At the end of the day, I take the position that this critique is not convincing with regard to the future of the Arctic. To put it succinctly, the dangers to both biophysical and human systems associated with the intensification of climate change and the impacts of globalization constitute a more serious threat than the dangers associated with resource wars triggered by the actions of powerful states, including China as well as Russia and the United States. In short, I am convinced that we must take seriously and act upon the proposition that "… preserving the Arctic as a zone of peace and cooperation is of the utmost importance" [27].

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Part IV
Risks of Instabilities from the Arctic Ocean State-Change

Chapter 15
Gaps in International Regulatory Frameworks for the Arctic Ocean

Timo Koivurova

Abstract When an area is about to transform in a dramatic manner, we can expect that policy analysts and legal scholars aim to identify whether there are gaps in governance of the region. After all, the *status quo* does not seem anymore plausible solution for such a place. This is particularly the case in regards to the Arctic Ocean, which is changing due to economic globalisation and climate change with an accelerating speed. The article will first look at what types of normative "gaps" we might observe in the gradually emerging new Ocean and then how the Arctic policy actors have planned to respond to these. It was two unrelated events – the Russians planted their flag underneath the North Pole on the Lomonosov ridge in August 2007 and 1 month later satellite imagery confirmed that the extent of summer sea ice on the Arctic Ocean had decreased to a record low – that triggered a serious discussion on how to best to govern a region that was seen by many as inaccessible desert without any need for governance. Yet, gradually, the region's states and other actors have identified the "gaps" that need to be addressed, together with procedures for filling them in. The article will finally examine whether the current consensus between the region's actors can be seen as the best possible approach to governing the Arctic Ocean.

15.1 Introduction

Increasingly, states and other powerful policy entities have engaged in discussions of whether the current international legal rules and policy responses applicable to the Arctic are enough to counter the vast challenges facing the region. This is not a new

T. Koivurova (✉)
Northern Institute for Environmental and Minority Law, Arctic Centre, University of Lapland, Lapin yliopisto PL 122, Rovaniemi FIN-96101, Finland
e-mail: timo.koivurova@ulapland.fi

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phenomenon. During the first stage of Arctic-wide co-operation – the Arctic Environmental Protection Strategy [1], an action programme that ran from 1991 to 1997 – in which the eight Arctic states (the five Nordic states, the Russian Federation, the United States and Canada) identified six main pollution problems whose sources lay mainly in the mid latitudes: noise, oil pollution, acidification, heavy metals, persistent organic contaminants and radioactivity. Along with the Arctic Council that was established in 1996 [37], the eight states and indigenous peoples, as well as other parties to the AEPS, examined what legal gaps existed in the international regulatory framework for responding to these problems and came up with an action plan to try to address those gaps. Yet, when the Arctic Climate Impact Assessment [2, 3] sponsored by the Arctic Council showed that the region is about to transform dramatically in manifold ways – and twice as fast as the rest of the world – a more ambitious debate commenced regarding the collective responses that we are lacking.

It is important to understand that when policy actors – not only states – debate international regulatory gaps or collective response problems, they are engaged in an intensely political activity. This type of discussion, which may well precede any regulatory efforts, is very much centered on how we frame the main problem, because it is this problem definition that directs us to see what the relevant "gaps" are. A good example is how the problems affecting the Arctic Ocean were defined in 2007. Virtually the whole world seemed to view the planting of a Russian flag underneath the North Pole in August 2007 as a kick-off for a game of power politics between states to determine who would stake a claim to most of the plentiful hydrocarbon reserves in the Arctic Ocean sea bed [18]. Some analysts were of the opinion that the event might even lead to military conflicts between the Arctic Ocean coastal states, and called for the institution of confidence-building measures through an international treaty. This perspective spotlighted failures by the present international regulatory framework to implement confidence-building measures that might avert major military confrontation or at least a serious political rivalry between the coastal states. We could even argue that the lack of active peace-promoting policies in the region constituted a regulatory gap.

15.2 Different Types of International Normative Gaps

There are different schools of thought in international law as to what can be regarded as "gaps" in international regulatory frameworks or collective response mechanisms, terms that are used synonymously in this article.[1] Most scholars of international law

[1] "Regulatory gap" refers to a legal analysis of what is covered by international legal rules and instruments, an approach that is seen by the present author as too limiting. If we think of gaps in regulatory frameworks, this term encompasses a broader set of "gaps" in our responses to a certain collective problem. The very act of studying these collective response measures or international regulatory gaps entails a commitment to a view that norms and rules do have an effect on state behaviour, an assumption that is not shared by some schools of international relations. If a scholar thinks that norms have no independent role in steering the behaviour of states, there is no need to perform any gap analysis either.

would subscribe to the view that states observe their international treaty obligations. The reason for this is straightforward: If states have themselves negotiated, ratified and implemented these treaties, it is only reasonable to expect that they will also be conscientious about observing these sources of international law.

15.2.1 Normative Gaps

Although mainstream scholars of international law regard customary international law (CIL) as an important source of international law, essentially all scholars recognize the problems that relate to this source: it is difficult to say exactly when a norm has become a principle of CIL. Moreover, since CIL develops via state practice, it is very often difficult to say with precision what CIL requires, since the principle of CIL may be unwritten.[2] What is more, it is often the case that principles of CIL remain at a fairly high level of abstraction.[3] A good example of this is the no-harm principle.

The no-harm principle requires all states to prevent likely significant environmental harm to other states' environment stemming from activities under its jurisdiction and control as well as to the environment of international areas. Even though there is not much state practice underpinning this principle, since 1996 the International Court of Justice [20–22] has confirmed that the principle is part of the corpus of international law relating to the environment. The most glaring problem is that there is hardly any state practice demonstrating that states assess in a regular fashion what the environmental consequences are for the areas beyond their national jurisdiction. This poses a problem for many international legal scholars. We can, and indeed must, say in the abstract that international law requires states to prevent significant environmental consequences for the high seas and obligates them to conduct EIA for any impacts on the high seas. Yet, most international lawyers would be hard pressed to say whether states will observe this rule in practice or not. We can thus assert that in formal legal terms there is no gap in preventing high seas pollution

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[2] This is not such a big problem nowadays, given that many CIL rules have been codified as treaty rules. A good example of this is the United Nations Convention on the Law of the Sea [42]; most of its provisions codify CIL, and thus treaty and CIL rules co-exist. In the Arctic, the distinction between the two is an important one, since the United States as a non-party to the UNCLOS admits that it is legally bound by most of the LOS provisions as embodiments of CIL. Although treaty and CIL rules co-exist, there are many times important differences in terms of legal consequences. For instance, since the US is not a party to the UNCLOS, none of the dispute settlement procedures prescribed in Part XV of the UNCLOS can be invoked against it.

[3] These problems are even more pronounced in relation to the third primary source of international law, general principles of law, since there are multiple views on how it might evolve. For instance, the International Court of Justice [19] has never based a decision on it, probably for the simple reason that the Court is hesitant to relying on a source that is not a product of state consent, explicit (treaty) or implicit (CIL).

from state-controlled activity, but that there is certainly a shortcoming when it comes to responding effectively.

Another difficulty lies with what are known as soft-law rules and instruments. These are rules and instruments that states adopt but with the clear intention that these will not become legally binding on them. Examples include guidelines, programs of action and declarations. These are guidance that is not legally binding on states, but does signal that they are at least politically committed to a course of action. From the strictly legal point of view, international legal scholars would agree that if a soft-law instrument is the only instrument guiding the behavior of states in a certain realm of action, there is an international legal gap. Yet, they would also agree that there is at least some normative guidance, meaning that some sort of collective response has been envisaged. A good example is the *Arctic Offshore Oil and Gas Guidelines* from the Arctic Council [4], which were adopted in the 1997 AEPS ministerial meeting. Plans call for applying the guidelines in practice and they have been revised twice (most recently in the 2009 ministerial meeting of the Arctic Council). Even though these soft-law rules are fairly specific, they are not legally binding on Arctic states and there is no mechanism for monitoring whether they are observed or not.

Some scholars would argue that the level of specificity – how clearly the norms guide behavior – is an important component when evaluating where we have real gaps. The underlying assumption here is that the more legal guidance states are given, the more likely it is that they will observe these rules. From this perspective, it is not enough to have an international treaty covering a certain problem or human activity; rather, the relevant question is whether the instrument provides sufficiently detailed guidance on how to behave. Good examples are Articles 206 and 205 of the *United Nations Convention on the Law of the Sea* [42], both of which prescribe a very general-level impact assessment procedure. Article 206 (*Assessment of Potential Effects of Activities*) reads:

> When States have reasonable grounds for believing that planned activities under their jurisdiction or control may cause substantial pollution of or significant and harmful changes to the marine environment, they shall, as far as practicable, assess the potential effects of such activities on the marine environment and shall communicate reports of the results of such assessments in the manner provided in article 205.[4]

There is no doubt that these two provisions are legally binding on the contracting states, but many international legal scholars would be concerned as to how many states actually observe such rules, which do not give clear guidance. The same applies to treaty provisions that are worded using many qualifiers, such provisions being plentiful in the *Convention on Biological Diversity* [10], for example. One, which has relevance in the Arctic, is Article 8j:

[4] Article 205 of the UNLCOS [42] reads: *"States shall publish reports of the results obtained pursuant to article 204 or provide such reports at appropriate intervals to the competent international organizations, which should make them available to all States."*

> Each Contracting Party shall, as far as possible and as appropriate:…
>
> (j) Subject to its national legislation, respect, preserve and maintain knowledge, innovations and practices of indigenous and local communities embodying traditional lifestyles relevant for the conservation and sustainable use of biological diversity and promote their wider application with the approval and involvement of the holders of such knowledge, innovations and practices and encourage the equitable sharing of the benefits arising from the utilization of such knowledge, innovations and practices;

As can be seen, the actual legal guidance is qualified by the phrases “as far as possible”, “as appropriate” and “subject to its national legislation”, meaning that the contracting states have a great deal of leeway to interpret what the provision requires. Some have even suggested that these types of provisions are soft-law provisions, with no legally binding content; nevertheless, the mainstream would contend that even such provisions are legally binding, although they accord considerable discretion to states as to how to implement and apply them. On balance, most lawyers would not question whether these are legally binding and would thus take the view that there is no formal legal gap; then again, most would admit that there is a “gap” in that the rules lack an effective collective response mechanism.

15.2.2 Governance Gaps

Even when specific treaty rules are in force, they may lack international institutional support; treaty rules without active institutional frameworks developing and overseeing their implementation and application do not adequately influence state behavior. This is why most Multilateral Environmental Agreements (MEAs) have become miniature inter-governmental organizations of sorts comprising various collective bodies to ensure that states in fact put the legal and soft-law rules into action [9].

One might also assert that a gap exists where collective response is concerned if there is no single institution responsible for a certain region even where there are various international treaty regimes in operation. The assumption here is that a consistent overarching regime – with internal co-ordination – is always better than a set of fragmented pieces of regulation, which may lead to institutional conflicts.

In conclusion, it can be said that for mainstream international lawyers the regulatory arrangements – or collective response mechanisms – that can most effectively close normative gaps are of the following kind. They are rules that need to be enshrined in international treaties that are legally binding on states; they need to be clear and precise enough to influence behavior; and they need to be supported by institutional machinery that continuously ensures that they are developed, supervised as to their observance, implemented via domestic legal acts and applied in practice. Finally, in the ideal case, sectoral regimes of the kind outlined above should find themselves embedded in an overarching treaty regime that enables co-ordination between sectoral regulations.

15.3 Gaps Become a Real Concern in the Arctic

Even though the United Nations Framework Convention on Climate Change [43] was concluded in 1992, and the Intergovernmental Panel on Climate Change [26] was established 4 years earlier, climate change had been discussed for a long time in terms of its future consequences. This is why the Arctic Climate Impact Assessment (ACIA), sponsored by the Arctic Council and released in 2004, is so significant: it showed that the climate in the Arctic had been changing for a long time, with very real consequences, and it projected a dramatic transformation of the region, change twice as intense as for the rest of the world.

This was a significant development where regulating the region is concerned. If the region is perceived as a type of polar desert – inhospitable and, more importantly, inaccessible –there is clearly no real need for the states to take strong regulatory efforts; after all, most of the pollution problems originate from outside the region. The ACIA showed that the region was undergoing an intense transformation, one that would open it up to various types of economic activities, especially in the marine areas where the sea ice is receding and thinning.

Yet, as is many times the case in international law and politics, the perceived realities are more important than what unfolds in reality. Two events happened to take place almost simultaneously. The Russians planted their flag underneath the North Pole, on the Lomonosov ridge, in August 2007, triggering very strong political reactions from other coastal states of the region. One month later satellite imagery confirmed that the extent of summer sea ice on the Arctic Ocean had decreased to a record low, indicating that sea ice was disappearing much faster than predicted by the ACIA. It was these two unrelated events that had the effect of sparking a serious policy debate between many of the region's states and the European Union on how the Arctic should be governed in the future.

15.3.1 Wild West

Initially, many in the media and academia took the view that what was taking place in the Arctic was a type of geopolitical struggle between nation-states over the Arctic Ocean sea bed and its projected hydrocarbon riches. The media and some commentators described the development as uncontrolled, a type of Wild West scramble in which states were trying to occupy as much of the emerging ocean's sea bed as possible for themselves and the companies operating in them. The storyline was that climate change was melting the sea ice, rendering accessible vast hydrocarbon reserves, which are safe and plentiful and very important for all the region's states.

This drama provoked swift political and legal action in 2007, first from the "foreign minister" of the European Union [15], who argued – in submitting a joint paper prepared by the High Representative and the Commission to the European Council on climate change and international security – that geopolitical struggle unfolding in the region required international co-operation.[5] This approach was followed by the European Parliament [13], which in its resolution called upon the Commission to be prepared:

> …to pursue the opening of international negotiations designed to lead to the adoption of an international treaty for the protection of the Arctic, having as its inspiration the Antarctic Treaty, as supplemented by the Madrid Protocol signed in 1991, but respecting the fundamental difference represented by the populated nature of the Arctic and the consequent rights and needs of the peoples and nations of the Arctic region; believes, however, that as a minimum starting-point such a treaty could at least cover the unpopulated and unclaimed area at the centre of the Arctic Ocean.

What is important to note here is that the European Union's High Representative and the European Parliament were in fact saying – together with the public media and very many international relations scholars – that there was almost no regulation in the Arctic, and that this situation called for an international treaty of some type, one focused on containing power politics and advancing sustainable development in the region.

15.3.2 The Sheriff Arrives

Yet, the "Sheriff" arrived fairly quickly. The Arctic Ocean coastal states convened a preparatory meeting as early as the end of 2007 and organized a political level meeting in Greenland in May 2008, where they issued what is known as the *Ilulissat Declaration* [23]. In the Declaration, they made it clear that there is already a comprehensive legal regime in place in the Arctic, the law of the sea.[6] In other words, there is no reckless vying for power over the Arctic Ocean sea bed but an orderly development that proceeds on the basis of the law of the sea. The chair of the Arctic Council at the time,

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[5] Even the journal *Foreign Affairs* published an article [7] arguing: *"The situation is especially dangerous because there are currently no overarching political or legal structures that can provide for the orderly development of the region or mediate political disagreements over Arctic resources or sea-lanes. The Arctic has always been frozen; as ice turns to water, it is not clear which rules should apply. The rapid melt is also rekindling numerous interstate rivalries and attracting energy hungry newcomers, such as China, to the region. The Arctic powers are fast approaching diplomatic gridlock, and that could eventually lead to the sort of armed brinkmanship that plagues other territories, such as the desolate but resource-rich Spratly Islands, where multiple states claim sovereignty but no clear picture of ownership exists."*

[6] The *Ilulissat Declaration* [23] states: "*In this regard, we recall that an extensive international legal framework applies to the Arctic Ocean as discussed between our representatives at the meeting in Oslo on 15 and 16 October 2007 at the level of senior officials. Notably, the law of the sea provides for important rights and obligations concerning the delineation of the outer limits of the continental shelf, the protection of the marine environment, including ice-covered areas, freedom of navigation, marine scientific research, and other uses of the sea. We remain committed to this legal framework and to the orderly settlement of any possible overlapping claims.*"

Norway, even went to the European Parliament to explain that there are no gaps in the international legal regime, but that the law of the sea and other treaties in force in the region, together with the Arctic Council, make it a well-managed region [40]. This was complemented by revised Arctic policy documents [8], and, importantly, by the European Commission and the Council of Ministers endorsing the view that there is no scramble for resources underway in the region [11, 12, 14].

The change in perspectives could not have been more extreme. In 2007, the prevailing conception was that there were almost no rules in force in the Arctic, whereas in 2008–2009 the Arctic Ocean coastal and the Arctic Council member states affirmed that there are in fact many rules, perhaps even too many, applicable in the region. The states further emphasized there was a comprehensive legal regime, the law of the sea, which regulates all the main ocean uses. Suddenly, the melting polar desert that was depicted as a type of Wild West, in which states vied for control over the sea bed, was described as a rule-governed place.

15.3.3 Manager Rules

After these extreme interpretations of what was (or was not) regulated in the region – a period from August 2007 to approximately the end of 2008 – the stances on whether there are gaps in the international regulations or shortcomings in the collective responses available started to become more nuanced. The coastal state meeting in Ilulissat, even though it caused some consternation over whether there was an inner circle co-operation emerging in the region, made it clear that the coastal states did not take the view that everything was already rule-governed in the region. In fact, those states pointed to ship-based pollution, maritime safety and other issues as possible fields of future precautionary/proactive regulation. A proactive approach would require that certain measures be taken before human activities in the region could commence or expand subject to the extent of scientific uncertainty, the risk of certain consequences and the seriousness and irreversibility of such consequences. Nevertheless, the states rejected a single comprehensive Arctic legal regime as a solution for the Arctic, given that they considered the law of the sea to be such a framework.[7]

[7] As provided in the *Ilulissat Declaration* [23]: *"In this regard, we recall that an extensive international legal framework applies to the Arctic Ocean as discussed between our representatives at the meeting in Oslo on 15 and 16 October 2007 at the level of senior officials. Notably, the law of the sea provides for important rights and obligations concerning the delineation of the outer limits of the continental shelf, the protection of the marine environment, including ice-covered areas, freedom of navigation, marine scientific research, and other uses of the sea. We remain committed to this legal framework and to the orderly settlement of any possible overlapping claims. This framework provides a solid foundation for responsible management by the five coastal States and other users of this Ocean through national implementation and application of relevant provisions. We therefore see no need to develop a new comprehensive international legal regime to govern the Arctic Ocean. We will keep abreast of the developments in the Arctic Ocean and continue to implement appropriate measures."*

Even though the European Parliament [13] had suggested to the European Commission that international treaty negotiations be initiated, the European Commission [11] declined to do so.[8] Yet it did express its concern over the nature of regulatory framework applicable in the region:

> The main problems relating to Arctic governance include the fragmentation of the legal framework, the lack of effective instruments, the absence of an overall policy-setting process and gaps in participation, implementation and geographic scope… The EU should promote broad dialogue and negotiated solutions and not support arrangements which exclude any of the Arctic EU Member States or Arctic EEA EFTA countries.

More importantly, the Council of Ministers representing the Member States of the European Union followed suit and considered the pragmatic approach of the Commission to be more viable than the treaty approach propounded by the Parliament.[9]

15.3.4 Some Gaps, Some Regulation, Not Much Unified Governance

Gradually, the problems started to be framed in the manner that has dominated the Arctic policy discussion (as they had been from the beginning of co-operation in the AEPS), namely, as environmental and human safety problems, not as traditional security threats. This led to a more realistic view of what the problems were, in particular where they related to the decreasing sea ice and opening possibilities for new economic activities, which seem to require regulation sooner or later, one way or the other.

And, gradually, this also led to a more realistic assessment concluding that there indeed are gaps in international regulatory frameworks in the region. This applies in particular to fisheries, of which only one small segment is potentially covered by a regional fisheries management organization (RFMO), the North East Atlantic Fisheries

[8] European Commission [11] noted*: "An extensive international legal framework is already in place that also applies to the Arctic. The provisions of the UN Convention on the Law of the Sea (UNCLOS) provide the basis for the settlement of disputes including delimitation…The European Parliament has recently highlighted the importance of Arctic governance and called for a stand-alone EU Arctic policy urging the Commission to take a proactive role in the Arctic. The parliamentary dimension of Arctic cooperation is crucial to raise awareness and to strengthen policy input. The European Parliament has been playing a valuable role in this respect."*

[9] As noted by the European Council [12]: *"The Council recognises the Arctic Council as the primary competent body for circumpolar regional cooperation and expresses its continued support for the applications by Italy and the Commission to become permanent observers in that body. The Council encourages Member States, and the Commission together with the EEA to continue to contribute to the work of relevant Arctic Council working groups….The Council believes that the EU should actively seek consensus approaches to relevant Arctic issues through cooperation also with Arctic states and/or territories outside the EU, Canada, Greenland, Iceland, Norway, the Russian Federation and the United States, as well as with other relevant actors with Arctic interests."*

Commission [35]. Since all eight Arctic states are parties to the Straddling Stocks Agreement [41] there is at least a basis for creating an RFMO for the Arctic Ocean if future needs so dictate; in fact, the idea that has already been proposed by the United States Congress [44]. There are no legally binding rules specifically tailored for Arctic shipping, but since 2002 there have been a set of *Guidelines for Ships Operating in Arctic Ice Covered Waters* [24], which were recently revised to apply to both polar regions [25]. There are also the non-legally binding *Offshore Oil and Gas Guidelines* of the Arctic Council [4], which seek to control how these activities are carried out in Arctic waters. Hence, if one takes the view that soft-law instruments – which many times are not monitored as to whether they are being observed – are influential policy instruments, it can be argued that there already exist fairly robust collective response mechanisms for future challenges in the Arctic Ocean. And if one considers the number of marine and other environmental treaties protecting the Arctic, among other areas, the total amount of applicable regulation becomes impressive. In view of progress to develop binding agreements for the Arctic Ocean, the search-and-rescue agreement that was adopted by representatives from all Arctic states at the ministerial meeting of the Arctic Council [5] is a significant step.

High seas and areas of ocean floor beyond national jurisdiction (whose boundaries will take a long time to determine) are still firmly under the ice in the Arctic Ocean but are in principle governed by the same rules as all other high seas and ocean floors in all the world's oceans and seas. The legal gaps where these are concerned are currently being debated in two parallel processes under the auspices of the United Nations General Assembly and biodiversity regime, respectively.[10]

The clearest gap with regard to collective response in the Arctic Ocean is that there is no single regime to administer the region, unlike the regimes in place for the: Baltic [16]; Mediterranean [6, 29–34]; or the North-East Atlantic [36]. Even if it is possible to describe the law of the sea as an extensive legal framework that applies in the Arctic Ocean, as the coastal states did in the *Ilulissat Declaration*, overall the UNCLOS is of such general character it requires more specific rules for its implementation. The UNCLOS, as well as the roughly identical customary law of the sea, contains types of constitutional rules – competencies for states in their responsibilities as flag, port or coastal states – and gives very general legal guidance as to how major ocean uses should be managed. What is important to note is that various parts of the UNCLOS favour regional implementation by the Convention, in contrast to unilateral state implementation.[11] And it is the lack

[10] The main processes are the United Nations Ad Hoc Open-ended Informal Working Group to study issues relating to the conservation and sustainable use of marine biological diversity beyond areas of national jurisdiction and the thematic Marine and Coastal Biodiversity programme under the Convention on Biological Diversity [10].

[11] This appears in many parts of the UNCLOS [42], for example Article 197: *"States shall cooperate on a global basis and, as appropriate, on a regional basis, directly or through competent international organizations, in formulating and elaborating international rules, standards and recommended practices and procedures consistent with this Convention, for the protection and preservation of the marine environment, taking into account characteristic regional features"*.

of regional governance that is the single clearest gap in the Arctic Ocean, given that the Arctic Council has limited capability to contribute to collective responses to future challenges in the region.

There is currently consensus – seen in the *Ilulissat Declaration*, the revised policy documents of the Arctic states [8] and the EU's evolving Arctic policy – on two things. First, it is the existing frameworks of governance that will best serve as platforms for responding to the challenges facing the Arctic. Much of the Arctic is under the sovereignty and sovereign maritime rights of the Arctic states, whereby it is these states that have the primary responsibility to close the gaps, in particular in their own jurisdiction. From the international perspective, the Arctic Council remains the predominant international high-level forum in the Arctic, even though the coastal states need to develop their policy on certain issues with a more limited participation. The LOS Convention and the law of the sea in general are immensely important in regulating in a general fashion many of the ocean uses in the Arctic Ocean and there are plenty of multilateral environmental agreements and other treaties that will cover one or another geographical region of the Arctic Ocean.

Secondly, all the relevant Arctic policy actors acknowledge that there are gaps in some international legal frameworks, and that the Arctic states need to think hard about closing these gaps before they become real concerns. The way to do this is not to try to negotiate an international comprehensive treaty regime but to proceed using a science-driven approach and adopting soft-law (and to some extent hard-law) instruments that operate on a sectoral basis; and this is to be done mainly by Arctic Ocean coastal states, Arctic marine states (including Iceland) and in the Arctic Council. Many efforts to these ends are underway to: develop a binding polar code for shipping [24, 25]; negotiate an RFMO for Arctic fisheries at some point in time; and incorporate the soft-law provisions of the Arctic Council's [4] Arctic *Offshore Oil and Gas Guidelines* into the national laws of the Arctic states.

15.4 Challenges

It is important to realize that the consensus discussed above on how to proceed with Arctic governance is premised on what the ideal ways are of responding to the gaps in international regulatory frameworks in a region that is undergoing a vast transformation. For instance, in Ilulissat, the coastal states argued that their aim is not only to do merely what is politically possible, but, in fact, what is the best for the Arctic Ocean; they described themselves as "responsible stewards" of a region undergoing vast transformation and, accordingly, expressed readiness for sectoral proactive regulation.[12]

[12] In the words of the *Ilulissat Declaration* [23]: *"The Arctic Ocean is a unique ecosystem, which the five coastal states have a stewardship role in protecting. Experience has shown how shipping disasters and subsequent pollution of the marine environment may cause irreversible disturbance of the ecological balance and major harm to the livelihoods of local inhabitants and indigenous communities. We will take steps in accordance with international law both nationally and in cooperation among the five states and other interested parties to ensure the protection and preservation of the fragile marine environment of the Arctic Ocean."*

This is important because the states are not debating what the politically most viable ways of closing the gaps are but what are the best ways of addressing them, a discourse that invites also scholars to debate what indeed are the ideal ways of closing the gaps in the regulation regarding the Arctic Ocean.

It seems fairly obvious that the current consensus among the major policy actors in the Arctic is a responsible one. They are – at least on a verbal level – adequately admitting the challenges ahead and trying to respond to these proactively rather than reactively. Still, there are challenges or outright problems in the approach they have adopted – a science-driven soft-law (and even hard-law) approach that incrementally regulates the region on a sectoral basis – which are studied at this concluding section.

There is much reliance on science, which is, of course, accepted on a general level by all concerned. But we have to be careful when we speak of a science-driven approach, asking what exactly it means. A good example is the joint project by two of the Arctic Council's working groups (Sustainable Development and Protection of the Arctic Marine Environment) titled *"Best Practices in Ecosystem-Based Oceans Management in the Arctic (BePOMAr)"* that was concluded in 2009 [17].

The approach adopted by the BePOMAr study – identifying best practices from currently implemented policies – offers the advantage of being a pragmatic course of action rather than an abstract exercise. The pragmatic focus can be seen in the study being confined to the Arctic region, whereby it identifies only practices that have already proven their value in the very particular conditions prevailing there and identifies six principles for stronger Arctic marine and, particularly, ocean management. Moreover, and given the coastal states' express reluctance to accept an overarching regime to govern the region, a principled approach to further international cooperation might constitute a more viable step forward than the immediate development of a formal legal instrument.

Yet, the shortcoming of this approach is that by focusing solely on the past and present experiences of the Arctic States in ocean management, the report fails to propose forward-looking solutions. Given that the regional impacts of climate change render the Arctic Ocean one of the fastest evolving marine environments in history, exclusive reliance on traditional and tested principles and solutions will fail to provide an adequate solution to the challenges facing the regional environment. Indeed, most of the economic activities anticipated for the Arctic in the future have either not materialized as yet or occur on a much smaller scale today. The conclusions of the report thus endorse the application of principles applied at present to what will be a different economic and environmental situation. This lack of ambition when it comes to providing innovative solutions contrasts with the apparent readiness of the Arctic States to adopt a proactive approach to cooperation and governance in the face of a changing climate. Overall, one cannot avoid thinking that if a science-driven approach does not incorporate elements of precautionary approach, the response to the vast changes in store will be a fairly limited one. Is that approach enough to counter the changes that are likely to be irreversible, severe and very comprehensive, which seem to call for more comprehensive governance solutions guided by the precautionary approach?[13]

There is quite some reliance on soft-law in the approach of the current consensus between major Arctic policy actors as well as in the sectoral approach. It is important to note that it is very difficult to pursue ambitious governance with soft-law instruments. These are normally used to test whether consensus among states is strong enough to proceed with a legally binding instrument. It is also worth considering that many times it is difficult, not impossible, to create monitoring mechanisms for soft-law instruments. The sectoral approach has problems of its own. Given that the governance arrangements in the Arctic Ocean are already very fragmented, it is important to ask whether the best way forward is to create even more sectoral regulation. The sectoral approach may preclude the creation of an overarching governance body for the region that could internally co-ordinate the component regimes in the region under a single umbrella – an approach that has been used in many semi-enclosed types of sea-areas. Now this role is performed to a very limited extent by the Arctic Council, which is only a soft-law forum, with limited funding and institutional machinery.

There is also much reliance on Arctic Ocean coastal states' acting as responsible stewards of the Arctic region. This approach, too, has its problems. The Ilulissat meeting and Declaration triggered a fierce response from the Inuit Circumpolar Council and Inuit leaders in the region. They argued that the Declaration reminded them of old ways of perceiving what sovereignty is and pointed out that today indigenous peoples have been guaranteed self-determination under international law, which also grants them rights in international policy-making [27]. This is especially obvious in the Arctic, since the indigenous peoples' organizations have long been permanent participants in the Arctic Council, and have established themselves as international policy-makers in the Arctic, whether the states like it or not. It is also important to remember that the European Union (EU) and non-Arctic states have rights, interests and responsibilities in the region, in particular when the sea ice recedes: most of the Arctic marine area is subject to freedom of navigation, thus guaranteeing access rights on the basis of the law of the sea and LOS Convention for all states and their commercial fleets. In any case, it is the EU and non-Arctic states such as China that drive the development of the Arctic with their industrial, energy, climate change and other policies, given that in terms of the markets the Arctic is still a provider of raw materials. The difficult question is how to include those states in Arctic governance in light of their current status as ad hoc observers in a soft-law body, the Arctic Council.

[13] One early but authoritative articulation of this approach is in Rio Declaration [39], principle 15: *"In order to protect the environment, the precautionary approach shall be widely applied by States according to their capabilities. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation".*

15.5 Conclusion

Overall, we have to ask whether there is a possibility to address all these concerns without one unifying legal foundation, merely building on an incremental, science-driven, soft-law (and to some extent hard-law) sectoral approach to respond to dramatic changes that are taking place in the Arctic Ocean. The current author – together with Professor Erik Molenaar – concluded that the more viable approach is to direct our efforts to a unifying, legally binding instrument for the region that establishes a regional governance body acting as a voice for the region. We came to this conclusion after an extensive study: we conducted an overview and gap analysis, compared the alternatives available for remedying the identified shortcomings in the legal regime and, finally, outlined elements that might be included in a legally binding instrument for the Arctic marine area [28].

As discussed above, even if the current approach of the Arctic states is a responsible one, we can certainly question whether it is the best one available. It is encouraging that the Arctic Council recently commenced the Arctic Ocean Review, conducted by the Protection of the Arctic Marine Environment [38] working group. The first phase will be to study regulatory gaps, with possible follow-up on how to best remedy these as well as shortcoming in collective response mechanisms. The review may well lead to reconsideration of whether the sectoral, proactive soft-law approach is really the best one for what is a dynamically changing region. What we can be sure of is that if a governance institution is willing to engage in a gap analysis such as the Arctic Ocean Review, it is receptive to change: it is ready to acknowledge that there are gaps in international regulatory frameworks that need to be addressed in one way or the other. It will be interesting to see whether this "gap" analysis results in stronger Arctic governance, since this is clearly what we need with the vast challenges facing the region.

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Chapter 16
Environmental Security Challenges and the Arctic Council's Arctic Marine Shipping Assessment

Lawson W. Brigham

Abstract The Arctic Council's Arctic Marine Shipping Assessment (AMSA) released in 2009 has become a framework for the Council's response to enhancing Arctic marine safety and environmental protection. AMSA can be viewed in three ways: as a baseline, snapshot for Arctic marine activity early in the twenty-first century; as a strategic guide for a host of stakeholders and actors; and, as a policy document of the Arctic Council since the report was negotiated and approved after consensus of the eight Arctic states was reached. The 2009 AMSA Report communicates to the global maritime community the current and future state of Arctic marine activity, and a set of complex drivers of change that must be considered in responding to the future. A set of 17 AMSA recommendations lays out a comprehensive strategy to address three themes: Enhancing Arctic Marine Safety; Protecting Arctic people and the Environment; and, Building the Arctic Marine Infrastructure. AMSA addresses issues related to Arctic indigenous communities, the legal governance of the Arctic Ocean, today's infrastructure limitations, and significant environmental issues including great concern for the release of oil in Arctic waters. As a holistic assessment providing an integrated framework from which to address the challenges of expanded, Arctic marine use, AMSA represents a first-order guide by the Council to an array of environmental security issues confronting the Arctic Ocean.

L.W. Brigham (✉)
Distinguished Professor of Geography and Arctic Policy, UA Geography Program, University of Alaska Fairbanks, P.O. Box 755840, Fairbanks, AK 99775, USA
e-mail: lwb48@aol.com

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16.1 Introduction

The Arctic Marine Shipping Assessment [3], which was approved by the Ministers of the Arctic Council in April 2009, has important relevance to the global maritime industry and all future marine operations in the Arctic Ocean. AMSA is a comprehensive assessment of current and future Arctic marine activity with a focus on marine safety and marine environmental protection, in keeping with the Arctic Council's mandates on environmental protection and sustainable development. Led by Canada, Finland and the United States under the Arctic Council's working group on Protection of the Arctic Marine Environment (PAME), AMSA is a follow-on effort to the Council's Arctic Climate Impact Assessment [1] and Arctic Marine Strategic Plan [4]. The linkage of AMSA to these two, earlier efforts indicates a significant continuity of work by the Arctic Council on environmental security issues. Without ACIA and AMSP, and close Arctic state cooperation, there would not have been an appropriate foundation to launch such a broad, complex assessment as AMSA.

AMSA is a holistic assessment providing an integrated framework from which to address the many challenges of protecting Arctic people and the marine environment in an era of expanding use of the Arctic Ocean. Arctic environmental issues are clearly inseparable from global and regional economic challenges, and AMSA makes clear, through a scenarios creation effort, the inter-relationships among a host of factors and drivers influencing the future of Arctic marine use in the twenty-first century. Following release by the Arctic Council AMSA has been viewed in three, distinct ways: (1) *baseline, historic snapshot* of Arctic marine activity early in the twenty-first century; (2) *strategic guide* for a host of Arctic and non-Arctic stakeholders and actors; and (3) *policy document* of the Arctic Council since the report was negotiated and approved through consensus of the eight Arctic States.

16.2 Defining Arctic Marine Use and the AMSA Database

One of the major challenges faced by the AMSA team was the lack of a comprehensive database of commercial marine use for the entire Arctic marine environment; such a complete Arctic use marine database had never been assembled. Any initiation of the conduct of a survey would also require a definition of what the AMSA team and PAME understood to be 'Arctic shipping.' A very broad definition was developed to include many types of ships and vessels such as: container ships; tank vessels; bulk carriers; icebreakers; cruise ships; fishing vessels; offshore support and supply vessels; ferries; tug-barge combinations; and, salvage ships; government survey ships and coast guard ships were also included [3]. This broad definition was designed to foster a holistic approach to commercial Arctic marine use across several sectors; understanding the levels of such diverse traffic would provide a first-order look at levels of discharges and stack emissions from the AMSA database. Submarines and major naval surface combatants were not included in the database. This omission is consistent with the Arctic Council's non-involvement in naval and military affairs.

A follow-on database of Arctic naval operations could, in theory, be added to the AMSA database *if* an accurate accounting of such operations might be obtained from the Arctic states and other nations who venture into the Arctic Ocean. In practice, voluntary release of such naval information remains highly unlikely and certainly not near-term. As of July 2011, the AMSA team knows of no other, improved Arctic marine use database, which includes Arctic naval operations (thus being more holistic than AMSA and representing all Arctic marine use). However, coast guard ships and naval enforcement vessels of several nations (for example, Unite States Coast Guard icebreakers and Canadian Coast Guard ships when provided by the Arctic states) were included in the AMSA database since they are routinely involved in operations such maritime law enforcement; search and rescue; pollution and disaster response; surveillance and monitoring; and, research. Future Arctic marine use databases could be further refined if all Arctic states provided voyage information on all government enforcement and survey vessels.

The AMSA team sent an electronic survey in 2006 to the Arctic Council's Senior Arctic Officials requesting ship and vessel data from their nation's Arctic waters during the calendar year 2004. The AMSA team was careful in the survey instrument not to delineate from what regions data was to be provided; it was the responsibility of the individual Arctic state to determine how they defined their 'Arctic waters' and how much traffic was observed and documented for the entire year 2004 (AMSA research began in 2005, so the 2004 data would be the most recent traffic in Arctic waters.). The entire Arctic Ocean and areas such as the Bering Sea; waters around Iceland, Greenland, and Svalbard; and the Norwegian and Barents seas were included in the responses of the Arctic states. The AMSA database should be considered a first-order estimate of Arctic traffic for a given year. This database is also a baseline as future surveys will surely be more robust, given improvements in Arctic surveillance and monitoring. One of the original ideas was to use the AMSA database to populate each Arctic Large Marine Ecosystem (LME) with numbers of vessels; total emissions and discharges could be estimated for each LME and potential environmental impact evaluated in this quantitative approach. While traffic levels in Arctic LMEs were illustrated in the AMSA report section on environmental considerations, a more quantitative approach (to emissions and discharges) was not undertaken since this level of detail was not required to develop the broad, final recommendations in the assessment. Future assessments of Arctic marine traffic relative to LMEs would have to contend with the changing nature of the environment such as Arctic sea ice changes. A much better understanding of the rate of change of LME dimensions and more refined levels of marine traffic would be required.

The AMSA database highlights several notable levels of Arctic marine activity. An estimated 6,000 individual ships were found to operate in or near the Arctic during calendar year 2004, including ships along the North Pacific Great Circle Route through the Aleutian Islands [3]. Fishing vessels represented nearly 50 % of this total and 20 % were bulk carriers. Higher concentrations of traffic were found four regions: off coastal Norway and northwest Russia (in the Barents, Kara and Pechora seas); along the North Pacific Great Circle Route off southwest Alaska; off Greenland's west coast (composed of cruise ships, supply traffic and fishing); and, around Iceland. There is clear evidence in AMSA of surface ships operating in the central Arctic Ocean for science and tourism (for example, from 1977 to 2008 there were 77 icebreaker voyages to the North Pole). A highly effective, year-round Arctic marine activity is the operation of commercial polar ships between Murmansk and the port of Dudinka on the Yenisey River supporting the industrial complex at Norilsk. Two additional large ship operations were noted in the AMSA database: an extensive, summer supply operation in the Canadian Arctic, and the seasonal (no ice cover) operation of large, bulk carriers (non-polar) to the world's largest zinc mine (Red Dog) off Alaska's northwest coast. Arctic traffic patterns such as these illustrate the diversity and spatial distribution of early twenty-first century operations, and provide a knowledge base from which to develop an international regulatory response.

16.3 Arctic Human Dimensions

In any expression of environmental security, the human dimension must have prominence and be integrated with changing environmental states and new ocean uses. One of the most important issues facing expanded commercial marine use of the Arctic Ocean is how these new uses and users will impact the economic, environmental, social and cultural well-being of Arctic communities. In particular, the impact on Arctic indigenous people of future Arctic marine operations was one of the key areas reviewed in AMSA. With the support of the Permanent Participants of the Arctic Council, the AMSA team held 14 town hall meetings in Arctic communities in Canada, Iceland, Norway and the United States. A key chapter in the AMSA [3] Report is devoted to the human dimension findings, complementing the Arctic Human Development Report [2] of the Arctic Council, and human issues are addressed throughout the AMSA report and in its final recommendations. AMSA documents that future Arctic marine activities will include many non-Arctic stakeholders, multiple users in Arctic waterways, and the potential for overlap of new Arctic marine operations with traditional, indigenous uses. Arctic marine spatial planning efforts will have to address the critical integration of indigenous marine uses with other future uses such as offshore development of oil and gas, marine tourism, fishing, and increased routing across waters once used solely by coastal inhabitants.

Many studies of the Arctic Council (e.g., ACIA, AHDR, AMSP), including AMSA have shown that most local Arctic communities depend heavily on marine resources for subsistence; local hunters use the sea ice for travel and the local waters for transport by boat in summer. The AMSA town hall meetings represented an earnest attempt to reach out to local citizens and have them share their perspectives on how vital the marine environment is to their way of life. During the AMSA town hall meetings Arctic residents expressed their concern about the potential disruption of hunting practices and marine species, and their concern for oil spills. The Arctic communities in Canada, for example, recognized the potential economic benefits of increased marine activity (especially the possibility of longer seasons of navigation for summer resupply, and new jobs), but also expressed concern for the social, cultural and environmental effects of such expansion. Also discussed was the importance of early engagement of local residents in planned Arctic marine development projects. Such practices are felt to be successful in reducing the negative impacts and enhancing the positive benefits of new marine projects. Several key AMSA findings include: the uneven distribution of costs and benefits from marine shipping among and within Arctic communities and regions; the lack of a database for indigenous use in local waterways that could be used to develop multiple use management measures and potential mitigation strategies; the importance of Arctic sea ice to mobility and hunting of Arctic residents; and, the deep concern for oil spills in all regions, especially in remote communities where they risk losing vital marine resources and their cultural foundation and way of life.

16.4 Legal and Governance Framework

A critical finding in AMSA is that the *United Nations Convention on the Law of the Sea* [16] provides the fundamental framework for governance of Arctic marine navigation and overall marine use. Not surprisingly, UNCLOS sets out the *legal framework* for the regulation of shipping according to maritime zones of designation. And, significantly for the Arctic Ocean, UNCLOS allows coastal states the right to adopt and enforce non-discriminatory laws and regulations for the prevention, reduction and control of marine pollution in ice-covered waters (UNCLOS, Article 234). However, AMSA found that the national standards for regulating ship-source pollution in the Arctic are not consistent among the Arctic states.

AMSA affirms that the International Maritime Organization (IMO), of which all eight Arctic states are active, influential members, is the competent and appropriate United Nation's agency for issues related to international shipping including maritime safety, security, and environmental protection. Harmonization and uniformity of international maritime law and standards are the over-arching goals of UNCLOS and the work of the IMO. The IMO acts as a secretariat for most international maritime conventions and facilitates their global implementation through adoption of codes and regulations that become international rules and standards. Selected and significant AMSA findings for governance of Arctic shipping include:

- Voluntary IMO [8] international guidelines for Arctic ships (*Guidelines for Ships Operating in Arctic Ice-covered Waters*), in the areas of ship construction, equipment and operations have been developed, but there is a need to consider a legally-binding code in the future. The IMO currently is developing the first internationally binding instrument regulating shipping in polar waters, both the Arctic and Antarctic [10]. This 'polar code' will apply to cargo and passenger ships.
- There currently are no uniform international ice navigator training standards. Since AMSA, the Conference of Parties to the *International Convention on Standards of Training, Certification and Watchkeeping for Seafarers* [15] in June 2010 adopted major amendments including guidance for mariners operating in

polar waters. One of the STCW [15] measures specifically focuses on the competency of masters and officers operating in polar waters.
- Stricter environmental standards have neither been proposed nor established by IMO member states for the Arctic. IMO designation of the Arctic Ocean as a 'special area' would allow more stringent discharge standards, including ballast water, under the *International Convention for the Prevention of Pollution from Ships* [11]. IMO designation of the Arctic Ocean as an 'emission control area' could also be considered.

Since AMSA, discussions at IMO have involved issues such as emission control and black carbon, and the need for strict environmental standards for polar waters.

- The international liability and compensation regime [6] is fragmented and limited; also, no convention or protocol addresses damage to the high seas beyond national jurisdiction (of special consideration for the central Arctic Ocean).
- Specific international construction requirements for cruise ships operating in polar waters have not been adopted, and it remains uncertain how the operation cruise ships in polar waters will be addressed.

16.5 Scenarios and Plausible Futures of Arctic Navigation

Determination of uncertainties and creation of a set of plausible futures (scenarios) were critical to understanding the future of Arctic marine navigation in 2020 and 2050. The AMSA scenarios process identified nearly 120 factors and drivers that could shape the future of Arctic marine activity. Among those factors determined to be most influential were:

- Oil and gas prices;
- Hard minerals and other global commodities pricing (such as zinc, copper, nickel, and iron ore);
- New resource discoveries, especially offshore oil and gas; new legal and governance regimes in the Arctic Ocean;
- Climate change and sea ice variability;
- World trade patterns (Fig. 16.1);
- New IMO agreements on Arctic ship construction rules and operational standards;
- Limited, seasonal windows of operation for Arctic shipping (considering the economics of seasonal verses year-round Arctic marine operations);
- Escalation of Arctic disputes;
- Transit fees on coastal routes;
- Potential conflicts between indigenous and commercial uses of Arctic waterways; the emergence of China, Japan and Korea as Arctic maritime nations;
- Socio-economic responses to global climate change (for example, emission controls from ships); and

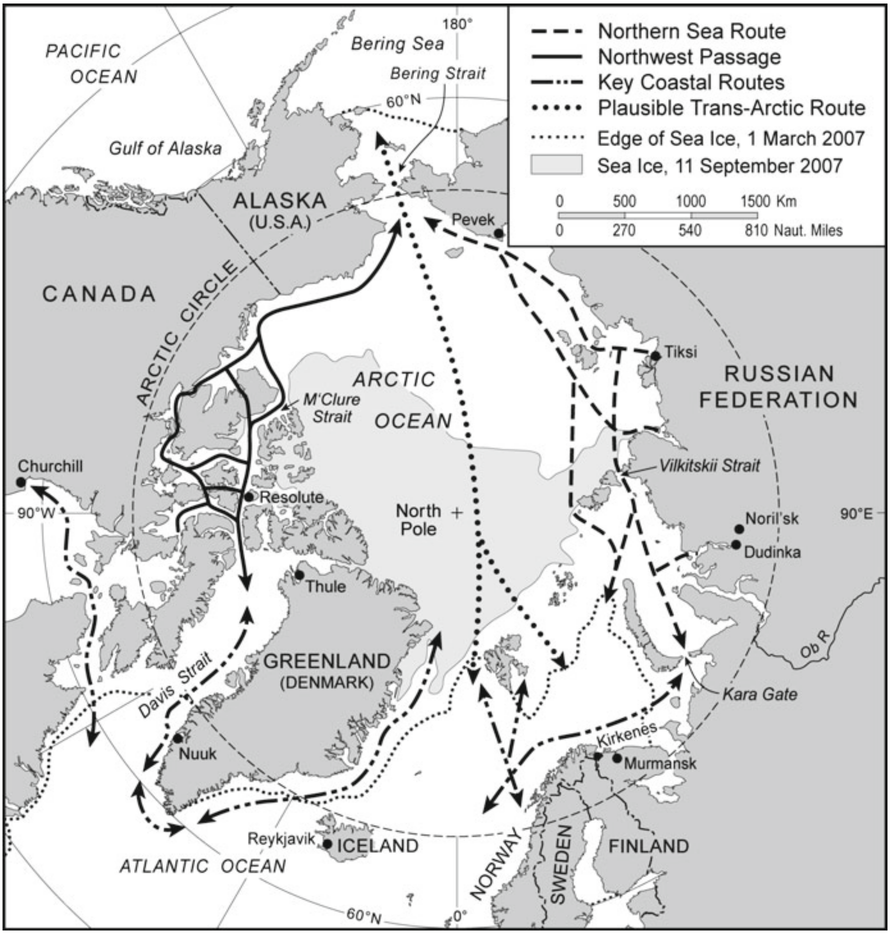

Fig. 16.1 Possible trade routes in and across the Arctic Ocean, including those associated with the Northwest Passage along the coasts of Canada and the United States as well as the Northern Sea Route or Northeast Passage along the coast of the Russian Federation. With disappearance of summer sea ice in the high seas of the Arctic Ocean, there also is the possibility of a Trans-Arctic route through the central Arctic Ocean. Adapted from AMSA [3]

- Actions of marine insurance industry related to expanded Arctic commercial shipping.

Arctic sea retreat in the AMSA scenarios effort is assumed to continue (based on the findings of ACIA), thereby providing improved marine access and potentially longer seasons of marine navigation. The diversity of the key drivers and factors illustrates the complexity of future marine uses of the Arctic Ocean and the challenges of addressing environmental security issues without integrated approaches.

The scenarios development process identified two, primary drivers or uncertainties: resources and trade (the level of demand for Arctic natural resources and trade); and governance (the degree of relative stability of rules and standards for marine use both within the Arctic and internationally). The two crossed uncertainties create a framework for four AMSA scenarios, or plausible futures:

- Arctic Race: A future of high demand for Arctic natural resources and unstable governance sets the stage for an 'economic rush' for wealth and resources (there is lack of integrate rules, regulations and adequate infrastructure).
- Polar Low: A future of low demand for resources and unstable governance (a murky future of minimal marine traffic and weak and undeveloped rules).
- Polar Preserve: A future of low demand, but with a stable and developed governance of marine use (a systematic preservation of the Arctic with slow development).
- Arctic Saga: A future of high demand for resources and trade with a stable governance of marine use and improved infrastructure (includes concern for preservation of Arctic ecosystems and cultures, and shared economic and political interests).

The AMSA scenarios assisted in the identification of the linkages of the Arctic to the global economic system and highlighted the importance of Arctic natural resources in driving increases in Arctic marine traffic. The AMSA scenarios effort served to communicate a complex subject ~ the future of Arctic navigation ~ in a powerful way to a broad Arctic and global audience. While global economic drivers are considered in AMSA to be paramount (driving Arctic natural resource developments), continued climate change and Arctic sea ice retreat are understood to provide greater marine access throughout the Arctic basin. The scenarios work also exposed a large number of uncertainties that will help shape the future of Arctic marine activity. Since the future is unpredictable, the AMSA scenarios are useful in that they provide alternative (and plausible) images of the future and can assist in the development of resilient strategies to deal with emerging uses of the Arctic Ocean. They are an integral and successful component to the work of the AMSA team and the Arctic Council.

16.6 Arctic Marine Infrastructure Limitations

The global maritime industry has come to the Arctic early in the twenty-first century without a comprehensive in place 'safety net'. AMSA has highlighted a major concern that this remote region is significantly lacking in basic and adequate marine infrastructure to support safe shipping, protect the environment and respond to maritime emergencies. Except for along the Norwegian coast and coastal regions of northwest Russia, there are large infrastructure needs and gaps in most regions of the Arctic marine environment. Evaluating the risks of Arctic marine operations is quite difficult when there is a huge deficit in infrastructure and minimal emergency response capabilities. Responding to a maritime incident or crisis situation in the Arctic is challenging for the both the Arctic states and marine industry. AMSA noted the limited Arctic hydrographic database and the lack of adequate meteorological and oceanographic observations important to safe navigation. Types of infrastructure taken for granted in other marine regions, but missing in much of the Arctic are: salvage; search and rescue; ports and port facilities; monitoring and surveillance; aids to navigation; environmental response capacity; and, reliable, full coverage communications (for example, AMSA indicated there are critical gaps to radio and satellite communications for voice and data transmission in the Arctic). Public and private investments in infrastructure (and potential joint, public-private partnerships) are required to reduce the risks of Arctic operations and complement expanded marine safety and environmental protection strategies.

16.7 Key AMSA Environmental Issues

AMSA includes a scientific review of the environmental impacts of Arctic marine activity and identifies key regions of heightened ecological significance that may be at greater risk to expanded marine traffic (Bering, Barents and Pechora seas; key straits including Bering Strait, Kara Gate, Hudson Strait and Lancaster Sound). Selected, AMSA key findings for environmental impacts include:

- Release of oil, either through accidental release or illegal discharge, is the most significant threat from Arctic shipping;
- Migration corridors for marine birds and mammals correspond broadly to Arctic shipping routes and geographic chokepoints;
- Anthropogenic noise produced through shipping and other vessel activity can have adverse effects on Arctic species. Ship strikes of whales and other marine mammals within routes of increased shipping are also of concern;
- Ship emissions (greenhouse gases, nitrogen oxides, sulfur oxides and particulate matter) may have negative effects on the Arctic environment and will increase proportionately with increased Arctic marine activity;
- Changes in Arctic sea ice (reductions in first-year summer ice and multi-year ice, and longer open water seasons) may have far reaching implications for Arctic marine ecosystems and can provide for longer seasons of navigation. Later marine operations in the autumn and earlier operations in the spring can increase interactions between ships migrating and caving species;
- Black carbon from Arctic ships could have significant regional impacts by accelerating ice melt and global impacts by affecting the reflection (albedo) of incoming solar radiation;
- Barents and Barents seas support two of the richest fisheries in the world and they are also regions of high traffic and Arctic marine activity. Any spill of oil or other hazardous substances could have large economic, environmental and social impacts;

- Risk of introduced invasive species to the Arctic marine environment can be enhanced due to changing climate and the potential for transfer from one Arctic marine region to another.

The environmental challenges of current and future Arctic marine operations are many. Most require global responses taken by the IMO and other bodies such as the International Association of Classification Societies, which in 2007 and 2010 have released unified requirements for polar class ships [7]. Arctic risk mitigation efforts at IMO have focused (for more than two decades) on development of a polar code of navigation that would include construction and structural standards, ice navigator training requirements, and polar safety equipment requirements. Although voluntary IMO Arctic shipping guidelines have been promulgated [8, 10], a mandatory or binding polar code will be a central element in an international regulatory system addressing polar ship operations. However, additional Arctic-specific measures are necessary, perhaps as amendments to existing IMO conventions, to adequately address stack emissions, invasive species, anthropogenic sound, and more. It is in IMO that non-Arctic states and maritime stakeholders and actors have opportunities to influence and share in the decision-making for new rules and initiatives to address marine safety and environmental protection issues.

16.8 AMSA Recommendations

The 17 AMSA recommendations (Box 16.1) were negotiated and approved by the Arctic Council and they represent a new level of Arctic state cooperation. They are collectively a 'policy statement' and an integrated framework that the Arctic Council can use as a strategy to address future developments in Arctic marine use. The Arctic states recognize that implementing the AMSA recommendations will require extensive international cooperation, particularly at IMO, and the creation of new mechanisms for Arctic marine infrastructure investment and emergency response. In the [3] Report the recommendations were outlined in three, inter-related themes: (1) Enhancing Marine Safety; (2) Protecting Arctic People and the Environment; and (3) Building the Arctic Marine Infrastructure.

Box 16.1 Arctic Marine Shipping Assessment (AMSA) Recommendations

Focus of the AMSA is marine safety and marine environmental protection, which is consistent with the Arctic Council's mandates of environmental protection and sustainable development, as established by the *Ottawa Declaration* [13]. Based on the findings of the AMSA, recommendations were developed to provide a guide for future action by the Arctic Council, Arctic states and

(continued)

Box 16.1 (continued)

many others. The AMSA recommendations are presented under three broad, inter-related themes that are fundamental to understanding the AMSA: Enhancing Arctic Marine Safety, Protecting Arctic People and the Environment, and Building Arctic Marine Infrastructure. It is recognized that implementation of these recommendations could come from the Arctic states, industry and/or public-private partnerships.

I. Enhancing Arctic Marine Safety

1. ***Linking with International Organizations***: That the Arctic states decide to, on a case by case basis, identify areas of common interest and develop unified positions and approaches with respect to international organizations such as: the International Maritime Organization (IMO), the International Hydrographic Organization (IHO), the World Meteorological Organization (WMO) and the International Maritime Satellite Organization (IMSO) to advance the safety of Arctic marine shipping; and encourage meetings, as appropriate, of member state national maritime safety organizations to coordinate, harmonize and enhance the implementation of the Arctic maritime regulatory framework.
2. ***IMO Measures for Arctic Shipping***: That the Arctic states, in recognition of the unique environmental and navigational conditions in the Arctic, decide to cooperatively support efforts at the International Maritime Organization to strengthen, harmonize and regularly update international standards for vessels operating in the Arctic. These efforts include:
   a. Support the updating and the mandatory application of relevant parts of the Guidelines for Ships Operating in Arctic Ice-covered Waters (Arctic Guidelines); and,
   b. Drawing from IMO instruments, in particular the Arctic Guidelines, augment global IMO ship safety and pollution prevention conventions with specific mandatory requirements or other provisions for ship construction, design, equipment, crewing, training and operations, aimed at safety and protection of the Arctic environment.
3. ***Uniformity of Arctic Shipping Governance***: That the Arctic states should explore the possible harmonization of Arctic marine shipping regulatory regimes within their own jurisdiction and uniform Arctic safety and environmental protection regulatory regimes, consistent with UNCLOS, that could provide a basis for protection measures in regions of the central Arctic Ocean beyond coastal state jurisdiction for consideration by the IMO.
4. ***Strengthening Passenger Ship Safety in Arctic Waters***: That the Arctic states should support the application of the IMO's Enhanced Contingency

(continued)

Box 16.1 (continued)

Planning Guidance for Passenger Ships Operating in Areas Remote from SAR Facilities, given the extreme challenges associated with rescue operations in the remote and cold Arctic region; and strongly encourage cruise ship operators to develop, implement and share their own best practices for operating in such conditions, including consideration of measures such as timing voyages so that other ships are within rescue distance in case of emergency.

5. ***Arctic Search and Rescue (SAR) Instrument***: That the Arctic states decide to support developing and implementing a comprehensive, multi-national Arctic Search and Rescue (SAR) instrument, including aeronautical and maritime SAR, among the eight Arctic nations and, if appropriate, with other interested parties in recognition of the remoteness and limited resources in the region.

II. Protecting Arctic People and the Environment

6. ***Survey of Arctic Indigenous Marine Use***: That the Arctic states should consider conducting surveys on Arctic marine use by indigenous communities where gaps are identified to collect information for establishing up-to-date baseline data to assess the impacts from Arctic shipping activities.
7. ***Engagement with Arctic Communities***: That the Arctic states decide to determine if effective communication mechanisms exist to ensure engagement of their Arctic coastal communities and, where there are none, to develop their own mechanisms to engage and coordinate with the shipping industry, relevant economic activities and Arctic communities (in particular during the planning phase of a new marine activity) to increase benefits and help reduce the impacts from shipping.
8. ***Areas of Heightened Ecological and Cultural Significance***: That the Arctic states should identify areas of heightened ecological and cultural significance in light of changing climate conditions and increasing multiple marine use and, where appropriate, should encourage implementation of measures to protect these areas from the impacts of Arctic marine shipping, in coordination with all stakeholders and consistent with international law.
9. ***Specially Designated Arctic Marine Areas***: That the Arctic states should, taking into account the special characteristics of the Arctic marine environment, explore the need for internationally designated areas for the purpose of environmental protection in regions of the Arctic Ocean. This could be done through the use of appropriate tools, such as "Special Areas" or Particularly Sensitive Sea Areas (PSSA) designation through the IMO and consistent with the existing international legal framework in the Arctic.

(continued)

Box 16.1 (continued)

10. ***Protection from Invasive Species***: That the Arctic states should consider ratification of the IMO International Convention for the Control and Management of Ships Ballast Water and Sediments, as soon as practical. Arctic states should also assess the risk of introducing invasive species through ballast water and other means so that adequate prevention measures can be implemented in waters under their jurisdiction.
11. ***Oil Spill Prevention***: That the Arctic states decide to enhance the mutual cooperation in the field of oil spill prevention and, in collaboration with industry, support research and technology transfer to prevent release of oil into Arctic waters, since prevention of oil spills is the highest priority in the Arctic for environmental protection.
12. ***Addressing Impacts on Marine Mammals***: That the Arctic states decide to engage with relevant international organizations to further assess the effects on marine mammals due to ship noise, disturbance and strikes in Arctic waters; and consider, where needed, to work with the IMO in developing and implementing mitigation strategies.
13. ***Reducing Air Emissions***: That the Arctic states decide to support the development of improved practices and innovative technologies for ships in port and at sea to help reduce current and future emissions of greenhouse gases (GHGs), Nitrogen Oxides (NOx), Sulfur Oxides (SOx) and Particulate Matter (PM), taking into account the relevant IMO regulations.

III. Building the Arctic Marine Infrastructure

14. ***Addressing the Infrastructure Deficit***: That the Arctic states should recognize that improvements in Arctic marine infrastructure are needed to enhance safety and environmental protection in support of sustainable development. Examples of infrastructure where critical improvements are needed include: ice navigation training; navigational charts; communications systems; port services, including reception facilities for ship-generated waste; accurate and timely ice information (ice centers); places of refuge; and icebreakers to assist in response.
15. ***Arctic Marine Traffic System***: That the Arctic states should support continued development of a comprehensive Arctic marine traffic awareness system to improve monitoring and tracking of marine activity, to enhance data sharing in near real-time, and to augment vessel management service in order to reduce the risk of incidents, facilitate response and provide awareness of potential user conflict. The Arctic states should encourage shipping companies to cooperate in the improvement and development of national monitoring systems.

(continued)

Box 16.1 (continued)

16. ***Circumpolar Environmental Response Capacity***: That the Arctic states decide to continue to develop circumpolar environmental pollution response capabilities that are critical to protecting the unique Arctic ecosystem. This can be accomplished, for example, through circumpolar cooperation and agreement(s), as well as regional bilateral capacity agreements.
17. ***Investing in Hydrographic, Meteorological and Oceanographic Data***: That the Arctic states should significantly improve, where appropriate, the level of and access to data and information in support of safe navigation and voyage planning in Arctic waters. This would entail increased efforts for: hydrographic surveys to bring Arctic navigation charts up to a level acceptable to support current and future safe navigation; and systems to support real-time acquisition, analysis and transfer of meteorological, oceanographic, sea ice and iceberg information.

Three key recommendations focused on IMO actions: supporting efforts at IMO to strengthen, harmonize, and regularly update international standards for Arctic vessels; updating and mandatory application of relevant parts of the IMO guidelines [8, 10]; and, augmenting IMO ship safety and pollution prevention, including the *International Convention on Safety of Life at Sea* [14] and MARPOL [11], for the Arctic. The Arctic states agreed to explore the possible harmonization of Arctic marine shipping regulatory regimes (within coastal state jurisdictions and in the central Arctic Ocean) and develop a comprehensive, multi-national Arctic search and rescue instrument [5]. Focusing on Arctic indigenous residents, the Arctic states will consider the conduct of surveys of Arctic marine use by indigenous communities (the goal would be integrate such information with other marine uses in regional marine spatial planning efforts) and determine if effective communications exist between Arctic communities and new shipping developments.

Two key recommendations related to future protection strategies are the calls to identify Arctic areas of heightened ecological and cultural significance and, exploring the need for internationally designated Arctic areas for the purpose of environmental protection (such as IMO designated 'Special Areas' or Particularly Sensitive Sea Areas). Four of the AMSA recommendations focus on specific impacts of expanded Arctic marine use:

- Enhancing protection from invasive species. All Arctic states are urged to ratify the international convention on ballast water management that was introduced by the IMO [9];
- Enhancing cooperation in oil spill prevention;

- Addressing impacts on marine mammals (work within IMO on mitigation strategies); and,
- Reducing air emissions (improved practices and innovative technologies for ships in port and at sea to reduce greenhouse gases, nitrogen oxides, sulfur oxides, and particulate matter). New initiatives for ship air emissions reductions will have to follow current IMO regulatory developments for the global shipping community.

AMSA recommendations on infrastructure included the recognition that improvements in Arctic marine infrastructure (such as navigation charts, communications, port services, ice navigation training, and more) are needed to enhance overall Arctic marine safety and environmental protection. The continued development of two, essential support systems are further recommended:

- Development of a comprehensive Arctic marine traffic system to improve monitoring and tracking of marine activity (this will require the sharing of ship traffic data in near real-time and augmentation of vessel management services);
- Development of circumpolar environmental pollution response capabilities (using circumpolar and regional capacity agreements).

The final recommendation is most crucial: investing in hydrographic, meteorological and oceanographic data in support of safe navigation and voyage planning in Arctic waters. A specific need is increased hydrographic surveys to bring Arctic navigation charts up to a level to support *current and future safe navigation*.

16.9 Conclusions

AMSA is a key step forward by the eight Arctic states within the Arctic Council to develop a coherent strategy for enhancing Arctic marine safety and environmental protection. The AMSA [3] Report is a major communications vehicle to a global community regarding the state of Arctic marine activity (current and future) and the complex set of issues that must be considered to effectively address the potential impacts of expanded Arctic marine use. The assessment also importantly recognizes the critical need for cooperation at all levels – local, regional, national and international – and promotes a multi-faceted approach to protecting people and the environment.

It is entirely possible that future Arctic marine use will not be a major cause for instability and discord in the Arctic. Addressing future use of the Arctic Ocean has already helped to foster international cooperation at the Arctic Council (with AMSA), at IMO (with the development of a polar code of navigation) and in other bodies (for example, the establishment of an Arctic Regional Hydrographic Commission in 2010 under the International Hydrographic Commission). The May 2011 signing of a binding Arctic search and rescue agreement [5] among the eight Arctic states at the Seventh Ministerial Meeting of the Arctic Council is a significant milestone in the history of Arctic cooperation. The Arctic Council task force for this agreement, called for in AMSA, was co-lead by negotiators from the United States and the Russian Federation with involvement of each of the Arctic states.

It was also agreed at the 2011 Nuuk Ministerial [12] that a new task force will begin to formulate an agreement on oil spill response capacity in the Arctic, again a critical need identified among the AMSA recommendations. The Arctic SAR [5] and oil spill initiatives by the Arctic Council illustrate how AMSA is an effective framework and policy document for the Arctic Council, with follow-up implementation and action on its recommendations being taken by the Council. Moreover, the Arctic SAR [5] agreement itself reveals how an intergovernmental (non-binding) forum, such as the Arctic Council, can develop a binding agreement among the member states of that forum.

In summary, AMSA could not hope to address all of the issues related to such a broad concept as 'Arctic environmental security.' However, it has clearly simulated engagement by the Arctic states and many stakeholders on the challenges of Arctic marine transportation and fostered close international collaboration and dialogue in Arctic affairs.

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Chapter 17
Oil and Gas Development and Opportunities in the Arctic Ocean

Robert J. Blaauw*

Abstract The first Arctic onshore oil well was drilled in Canada in 1920 and the first offshore well was drilled in Alaska in 1963. Large Arctic onshore operations started in the 1970s in Alaska and Russia. Offshore production from the sub-arctic region started much more recently. Currently, the Arctic produces about 10% of the world's oil and 25% of its gas, of which the majority is produced in the Russian Arctic onshore. The United States Geological Survey (2008. Circum-Arctic resource appraisal: estimates of undiscovered oil and gas north of the Arctic Circle. http://pubs.usgs.gov/fs/2008/3049/fs2008-3049.pdf. Accessed 20 Aug 2011) estimated that the Arctic contains 13% of the world's 'yet to find' oil, 30% of the world's 'yet to find' gas, and 20% of world's 'yet to find' natural gas liquids. About 84% of these estimated resources are believed to lie offshore. Overall hydrocarbon resources in the Arctic are equivalent to some 10 years of total global oil and gas demand at current consumption rates. Developed responsibly, they will help provide secure energy for the world as the time of 'easy oil' comes to an end. This article aims to present an overview on Shell's perspectives on upstream oil and gas exploration and development and related issues in the Arctic Ocean.

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* Royal Dutch Shell plc. (RDS) and the companies in which it directly or indirectly owns investments are separate and distinct entities. But in this article, the collective expression 'Shell' may be used for convenience where reference is made in general to these companies. Like the other (interim) holding companies in the Shell Group, RDS is not (directly) involved in the operations of Shell companies. Shell companies are independent companies and are autonomously managed. Shell companies do not instruct each other, but are deemed to comply with those "Shell" policy rules that they have adopted themselves. If and to the extent this article contains forward-looking statements these are based on current expectations and assumptions and involve known and unknown risks and uncertainties that could cause actual results, performance or events to differ materially from those expressed or implied in this article.

R.J. Blaauw (✉)
Sr. Advisor, Global Arctic Theme, Shell International Exploration and Production BV, Carel van Bylandtlaan 16,
P.O. Box 162, 2501 AN The Hague, The Netherlands
e-mail: Robert.Blaauw@shell.com

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17.1 Overview

Oil and gas development is nothing new to the Arctic and sub-Arctic. The first onshore oil well was drilled in Norman Wells in Canada in 1920 and the first offshore well was drilled in the Cook Inlet in Alaska in 1963. Large Arctic onshore operations started in the 1970s in Alaska Prudhoe Bay and in the Urengoy area in Russia. Offshore production from the (sub-) Arctic region started much more recently in projects such as Hibernia off Newfoundland, Canada, Sakhalin 1 and 2 in the far east of Russia and Snovit in the Barents Sea in Norway. Although there are some large offshore Arctic projects on the drawing board it will take a long time before new major projects will come on stream.

To date Arctic operations have produced some 40 billion barrels of oil and 1,100 trillion cubic feet of gas. Currently, the Arctic produces about 10% of the world's oil and 25% of its gas, altogether some eight million barrel of oil equivalent per day, of which the majority is produced in the Russian Arctic onshore. But the region holds substantial additional resources. The United States Geological Survey [10] estimated that the Arctic contains 13% of the world's 'yet to find' oil, 30% of the world's 'yet to find' gas, and 20% of world's 'yet to find' natural gas liquids, totalling around 400 billion barrels of oil equivalents. About 84% of these estimated resources are believed to lie offshore. In view of the overall lightly explored nature of the Arctic offshore theatre these numbers are speculative but nevertheless give a good indication of the size of the prize. Overall hydrocarbon resources in the Arctic are equivalent to some 10 years of total global oil and gas demand at current consumption rates. If these resources are developed responsibly over the coming decades, they will help provide secure energy for the world as the time of 'easy oil' comes to an end.

The Arctic is a magical place and its environment provides unique challenges for all sectors, including the oil and gas industry. The main issues our industry has to deal with include:

- Answering to global concerns of climate change;
- Minimising the impact on indigenous peoples' subsistence fishing and hunting culture and on Arctic biodiversity and ecosystems;
- Operating safely and reliably in Arctic, including preventing and responding to oil spills;
- Consistent and effective regulatory framework in support of oil and gas development; and
- Appropriate operational standards across the Arctic, to ensure it is developed in a sustainable manner.

These key issues, and how the oil and gas industry is dealing with them, will be detailed in the following sections. The importance of cooperation between governments, industry, Arctic residents and key stakeholders in meeting the Arctic challenges and reaping all the benefits from oil and gas development, cannot be stressed enough. Over the last four decades the industry has learned from Arctic oil and gas and pipeline projects located onshore but operating in the icy marine environment is a step change in terms of Arctic challenges.

17.2 Climate Change

Limiting greenhouse gas emissions to avoid the impact of serious climate change – whether to the Arctic or the world as a whole – is a challenge that can only be met globally by industry, governments and consumers together. Climate change impact on the Arctic region is determined by global emissions of greenhouse gases rather than Arctic development. Shell therefore focuses on pursuing sustainable development in the Arctic, while addressing greenhouse gas emissions on a global level.

We work to mitigate carbon dioxide emissions from our operations and products, and help our customers to do the same. We also advocate the wide-ranging policy-changes needed from governments. Shell advocates for a carbon market based approach to reducing CO_2 emissions and welcomes pledges made at Durban to define new market mechanisms under a successor treaty to the Kyoto Protocol.

We also support the ultimate objective of the UN Framework Convention on Climate Change (UNFCCC) "to stabilise greenhouse gas concentrations at a level that would prevent a dangerous impact on the world's climate system". Progress at Durban on setting out a path forward for governments is welcome but from a business perspective, the more early certainty governments can provide in terms of regulatory intent, the sooner business can prepare for regulatory decisions.

We consider CO_2 emissions in our commercial decisions and look to optimise them across our global portfolio of activities. To do this, we are focusing on four key areas: supplying more natural gas for electricity generation; supplying more biofuels for road transport; progressing carbon capture and storage (CCS) and implementing energy efficiency measures in our operation.

Shell is taking an active role in several international initiatives, which looks at Arctic climate change implications, such as through the Commission on Arctic Climate Change of The Aspen Institute [9] – which has issued a report including principles of governance and a set of recommendations to specifically meet the challenges of climate change and increased human activities in the Arctic.

17.3 Indigenous Peoples

Thoughtful, considered stakeholder engagement is critical to our success in the Arctic. Every area and every people is different and there is no perfect recipe. Winning the trust of local communities and other stakeholders is a long, complex and resource demanding process, and one we haven't always gotten right, but we continue and want to learn. Although scarcely populated the Arctic is home to some four million people, 10% of which are Indigenous Peoples.

Particularly important to us is our relationship with the Indigenous People of the Arctic, whose subsistence lifestyles and culture often depend on the oceans. We recognise that these groups are vulnerable to the impacts of large projects, and failure to minimise potentially negative impacts on Indigenous Peoples carries risks both to the communities affected and to us as a company. Shell is dedicated to mitigate negative impacts on, and to develop opportunities in partnership with Indigenous Peoples in the areas we operate.

In Alaska, Shell has worked with many native owned corporations and economic development groups on its projects. We also rely on input from Inupiat subsistence advisors on the North Slope to build traditional knowledge and subsistence concerns into our plans and help minimise our impact. In a simple example, we changed the colour of our vessels from orange to blue, to avoid disturbing sea life.

The Sakhalin Energy Investment Company, of which a Shell company is a partner, established a consultation group to help preserve the native lifestyles, which recently published the first book in Uilta, a nearly extinct native language.

The bottom line is that local communities need a seat at the table and Shell is committed to this approach. We have learned that working with communities and Indigenous People is good for business. It can help us reduce cost by increased access to traditional knowledge, help us in the design of safer and more environmentally sound operations and facilities, and develop a valuable local workforce. If done right, the people of the regions where we operate can be partners in the success of our projects.

17.4 Arctic Biodiversity

An issue that requires wide international and cross-sector collaboration is the protection of Arctic biodiversity and ecosystems. The Polar Regions are some of the few remaining untouched ecosystems on the planet. Their pristine beauty is a legacy that we need to maintain for future generations. We recognise that oil and gas operations can potentially impact biodiversity, and have in place Shell-wide requirements to help mitigate this. We consider biodiversity early in new project developments and collaborate with experts from our environmental strategic partners to help manage biodiversity and protect areas with rich and delicate ecosystems.

In the Arctic we work with the International Union for the Conservation of Nature, Wetlands International, The Nature Conservancy and Earth Watch. Together with these non-governmental organizations (NGO) we look at cross-sector strategic Arctic impact assessment and best practices, options for Arctic marine 'ecosystem based management' and studies into the impact of climate change on permafrost and preservation and recovery of Arctic wetlands.

As an oil and gas company we cannot review the overall impact of economic development on the Arctic alone. All industries active in the Arctic, including fishing, mining, tourism, shipping and oil and gas, together with indigenous people's associations, governments and NGOs alike must come together to agree on standards and best practices for sustainable Arctic development.

On a positive note, oil and gas developments also mean gaining better scientific understanding of the Arctic Ocean and its ecosystems. Shell has so far spent more than $50 million on science based research programs in Alaska, for example. The resulting data helps us form the basis for decisions we make on future development. However, the debate continues about the need for more science before we start exploring – but without actual operations true data gathering required prior to decision making on oil and gas developments and its impacts will not occur.

17.5 Oil Spill Prevention and Response

Each step of oil and gas development and operation in the Arctic – from seismic activities, exploration drilling, planning and finally engineering, construction and installation – is sensitive to the physical environmental. Challenges include limited open-water seasons, winter darkness, remoteness and a wide variety of ever-changing ice conditions.

Safety, reliability, and cost effectiveness remain at the forefront of our technology development and deployment effort. But another important part of our portfolio is advancing technology, which helps reduce our operating footprint and our oil spill prevention and response capabilities. We recognise that one of the most serious concerns is whether the industry has the capability to manage a potential oil spill. Can an oil spill like the Macondo blow-out in the Gulf of Mexico happen in the Arctic?

Shell has a good record of spill prevention in the Arctic and sub-Arctic, and we have always recognised oil spill prevention as a key element of Arctic design and operations. Safety is our first priority, and we have multiple barriers in place to prevent the release of oil in our operations. This includes the maintenance, inspection and testing of safety critical systems with the aim of ensuring that they function in accordance with pre-defined performance standards. Despite the very best efforts to prevent spills, we do recognise that in a worst-case scenario they may happen. We therefore have a solid response programme for our Arctic operations and further our research as a company and with joint-industry projects to strengthen this.

Shell's participation in the Marine Well Containment Company, which is constructing a $1 billion Gulf of Mexico undersea well containment system is an example of cooperation to improve the industry's overall capabilities. Shell has also developed a sub-sea cap and containment system for Alaska, which is intended to capture and recover hydrocarbons at the source in the unlikely event of a well control incident.

The Shell Alaska venture is committed to make a second drilling rig available to allow for relief well drilling capabilities, should it be needed. It should be noted that exploration drilling in the Arctic is carried out in the open water season when sea conditions are benign, there is no sea ice and there is continuous daylight. In such remote locations as Alaska and North Sakhalin, far away from main ports, we bring our own fleet of oil spill response vessels that are on stand-by on a 24/7 basis. Shell and other oil companies have participated in a joint industry project led by the Norwegian SINTEF and are leading an industry 4 year project on further developing research and technology for oil spill response in ice covered waters [8].

Two large field experiments demonstrated that ice can act as a natural boom and reduce further spreading of oil. It also showed that in-situ burning and dispersion of oil can be effective response methods in icy conditions.

However there remain ongoing challenges for effective recovery of oil under ice should a leak occur in the mid-winter and that is why designing for integrity and effective maintenance are crucial to prevent any spill in the first place. Pipelines already exist in challenging Arctic and sub-arctic environment including Sakhalin Island, Canada, the North Sea and Alaska's own Cook Inlet. Pipelines are required to be fitted with shut-off valves throughout so that in the event of a leak, each section of the pipe can be sealed in to avoid continuous discharge. Shell has demonstrated this technology very effectively during extreme hurricane events in the Gulf of Mexico, to minimize spills even when whole sections of pipelines were compromised.

We are taking part in cross-sector Joint Industry Projects through the International Association of Oil and Gas Producers and its subsidiaries. Shell is leading the taskforce with oil spill response experts from eight major oil companies, looking at a the fate of dispersed oil under broken ice, improved oil detection in Arctic waters and broken ice and at low visibility, among other things.

17.6 The Energy Challenge

So, in light of climate change and the associated perceived risk of Arctic oil and gas development [1], why then pursue development of these resources at all? The answer is that in the current and future energy realities the vast Arctic oil and gas resources play a major role in the energy challenge the planet's population is facing.

This is the reality we all face. The world's 7.0 billion people are likely to increase to nine billion by 2050, and humankind is expected to be using twice the amount of energy we do today. Meanwhile the world needs to drastically cut greenhouse gas emissions to avoid the worst effects of climate change. Today, fossil fuels meet 80% of the global energy demand, but increasingly the energy mix must be supplemented by a diverse range of energy sources, from fossil fuels (with an emphasis on gas) to renewable sources (such as bio-fuels). But, experience tells us that it takes 30 years for a new energy technology to reach 1% share of the mix. So, although wind, solar and other renewable sources are growing fast, fossil fuels will continue to meet the bulk of global demand for decades. Even by 2050 these energy sources are expected to still meet 60% of demand – much of it from resources not even found yet. The hydrocarbons we need also will be more difficult and more expensive to find and produce and the considerable resources found in the Arctic Ocean will be an important source in this context.

From a European perspective, we cannot afford to overlook Arctic oil and gas. The IEA [3] World Energy Outlook foresees that oil and gas will account for between 52% and 60% of EU energy demand by 2030. Yet European production of oil and gas is declining. By 2030, oil production in the European Economic Area (EEA), which includes Norway, will meet some 13% of its demand for oil. EEA gas production will meet 35% of gas demand.

17.7 Standards and Governance

Effective governance through Arctic-specific international standards and adapted national regulations and standards is critical in managing and mitigating risks and securing safe, reliable and environmentally responsible development. Decades of experience have shown that it is possible to achieve well-defined and effective governance systems for oil and gas operations in the Arctic. These systems encourage the selection of those upstream operators who are best able to deploy and often improve the most effective and reliable technologies – in full compliance with environmental regulations and guidelines.

As we know, the Arctic is a unique environment in terms of its physical characteristics (extreme cold, ice, darkness, seasonal windows) and social characteristics (indigenous people, many who still follow a full or partial subsistence lifestyle). It is also characterized by strong connections both physical (e.g., Arctic Ocean), political (e.g., Arctic Council, global NGOs), and relationships among indigenous people. These shared characteristics and connections are such that standards between regions must be carefully managed or harmonized so as to not undermine our commitment to protect people and the environment, avoid any pretence of being seen as employing double standards, and create a level playing field for all. We believe that Industry must cooperate on standards, which will need to be based on the specific local conditions, scope of the oil & gas operation, legal requirements and rigorous risk assessment and may therefore not be the same for all Arctic regions ("one size does not fit all").

The Macondo incident likely will lead to new regulatory frameworks and legislation in many parts of the world. This is an opportunity to show lasting, thoughtful leadership in this important area going forward. We encourage regulators to work together with industry, to create a common set of goals and a timeline for new regulations. It is our experience that goal oriented regulation leads to significant and sustainable performance improvement. Continued engagement and cooperation with various national and state regulatory authorities is hence required to promote strong and stable policies, relevant standards on the basis of a thorough risk assessments and a stable fiscal regime needed for an investment climate that encourages long term development of oil and gas projects.

The Policy should be very clear: minimize the impact on the environment, and as such, follow industry best practices and adhere to all regulatory and legal requirements.

17.8 Economic Growth

In addition to its important contribution to world energy supplies, oil and gas developments can also provide other clear benefits to the people of the Arctic region – most importantly economic growth and stability.

Take Greenland, for example: Prime Minister Kuupik Kleist (2010) stated in an interview with a Canadian newspaper [7] that oil and gas developments will give the people of Greenland more muscle to reach full financial independence from Denmark

> If a huge amount of oil should be exploited, there are some basic developments that will be possible in terms of developing our democracy, in terms of developing our infrastructure; also in terms of making the Greenland people stand on their own feet, both politically and economically…

Oil and gas activities are major contributors to regional and national economies. They are drivers of social and economic change – with revenues from taxes and royalties boosting the economy, new high-quality employment opportunities and its potential to stimulate local and national businesses. Shell is a supporter of a portion of this revenue stream being shared directly with local communities. It is often stated that sustainable development and oil and gas do not go together but for countries, which plan accordingly, public revenues can form the basis for major and lasting improvements in public services, such as infrastructure and standard of living. In addition the oil and gas industry provides the opportunity to develop a strong local industry, competing internationally, as a basis for further industrial development. Norway is a good example – where oil and gas revenues and spin-off industries are providing a lasting benefit to the nation as a whole.

17.9 Job Creation

The arrival of a large number of foreign workers can affect social and cultural balances in small communities. By involving the people of the Arctic in oil and gas activities one can harness benefits while providing ways to anticipate and mitigate negative impacts. If vocational training and capacity building is introduced early, and operators honour their commitment to ensure local content and employment, long-term, high-value jobs can be created.

On Sakhalin Island in the far-eastern Russia unemployment plummeted with the development of Sakhalin II, reducing it from approximately 20% in 1999, to only 1% in 2009. In Shell's operations in Alaska, indigenous-owned businesses are heavily involved in oilfield and other support services.

Economic activity resulting from outer continental shelf (OCS) development in the Beaufort Sea and Chukchi Sea could generate an annual average of 54,700 jobs nationwide, with an estimated cumulative payroll amounting to $145 billion (in 2010$) over the next 50 years [5]. It is estimated that about 30,100 jobs would be generated from the Beaufort OCS development and 24,600 jobs from development of the Chukchi Sea OCS.

17.10 Conclusion

Some of the non-technical risks we are facing in the Arctic are not ones Shell can or should solve or manage alone. Working with others is therefore an integral part of what we do. We partner up with NGOs, academia and experts, Arctic government representatives and industry bodies not only to address concerns about our operations, but to engage on wider environmental and social issues.

Given all of the development pressures on the Arctic from transportation to mineral resource development, we need to collaboratively develop regulatory frameworks that provide more certainty for all stakeholders. A litigious approach of "we versus them" will only result in unnecessary delays in establishing frameworks that allow for multiple uses, including protecting the way of life and the environment in the Arctic.

Lets take a look at what has happened in the Alaska Offshore continental shelf.- is this the way to approach Arctic development globally?. Things need to change. After 7 years and over $4 billion in investment there were still no exploratory wells drilled. Delays in permits to drill, ambiguous requirements and standards which made the operating environment unpredictable proved an enormous challenge for us as a Company. Focussing on working together for the good of the sustainable development of the region rather than developing strategies for the courtroom is the way forward.

Shell is committed to develop a common understanding of what must be done so we can help create frameworks that governments can readily adopt, and which provide both industry and communities the certainty they deserve.

Working in the Arctic is "Difficult yes, Impossible no". Yes, there are challenges, but the rewards are also great.

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Chapter 18
The Arctic Ocean and UNCLOS Article 76: Are There Any Commons?

Lars Kullerud, Yannick Christian Beaudoin, Jean-Nicolas Poussart, Peter Prokosch, and Harald Sund

Abstract Media, research literature, workshops, and political meetings over the past years have had a surprisingly rich, and partly under informed by fact, debate on race for resources and possible conflicts in the Arctic. This paper takes a careful look at UN Law of the Seas, Article 76 which regulate rights to the seabed outside exclusive economic zone for the Arctic Basin. It is evident that the Arctic will in future include seabed not under jurisdiction by any of the coastal states, but all area with expected major resources is already, or will become unquestionably under control by one of the coastal states. It is also evident that any potential territorial disagreements will be about relative small areas, and these areas have very low expectation for major resources.

18.1 Introduction

Over the past few years there has been an ongoing debate about the stewardship and ownership of the Arctic Ocean in the context of international regulatory regimes [10]. The states surrounding the Arctic Ocean are of the view that current international

L. Kullerud (✉)
University of the Arctic, Rovaniemi, Finland

UNEP/GRID-Arendal, The UN House, Teaterplassen, 3, N-4836 Arendal, Norway
e-mail: lars.kullerud@uarctic.org

Y.C. Beaudoin • J.-N. Poussart • P. Prokosch
UNEP/GRID-Arendal, The UN House, Teaterplassen, 3, N-4836 Arendal, Norway

H. Sund
Geocap AS, Valberget 11, 4006 Stavanger, Norway

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law is sufficient [7], while others argue the need for additional governance mechanisms for the Arctic.

Regardless of their position in this debate there is a general consensus that the United Nations Convention on the Law of the Sea (UNCLOS) article 76 is an essential basis when it comes to rights to, and responsibilities for, the ocean floor and its resources [1]. This article documents a plausible outcome based on the application of article 76 and discusses its consequences.

18.2 Article 76 and Outer Limit of Continental Shelf

According to Article 76 of the *United Nations Convention on the Law of the Sea* [8], the continental shelf of a coastal state is the submarine natural prolongation of the territory of that state and may, in some cases, extend beyond the 200 nautical miles Exclusive Economic Zone (EEZ). Figure 18.1 depicts the EEZ for the Arctic Ocean. Moreover, Article 76 provides that the coastal state exercises sovereign rights over that continental shelf with respect to its resources. Outside the EEZ, these rights (and responsibilities) concern the resources on and below the seabed, but not to resources in the water column.

Article 76 together with the technical guidelines of the Commission on the Limits of the Continental Shelf (CLCS) explains how a state shall delineate and document the outer limits of its continental shelf. Based on a proposal from a state, the CLCS evaluates the scientific and technical arguments provided and either agrees to the submission or recommends further documentation. The latter was the case with the 2001 Russian submission on the outer limits of the continental shelf, where Russia now works to collect additional information. Figure 18.2 maps the Russian 2001 and Norwegian 2006 submissions. In the end, which part of the seabed is controlled by sovereign states and which part is not under any national jurisdiction will become final and binding. The part outside national jurisdiction is defined as “the Area” and is managed by the International Seabed Authority (ISA). It is important to be aware that this system does not decide at all on boundaries between states, only whether seabed is appurtenant to a state or is part of “the Area”.

In many cases the application of Article 76 may bring the continental shelf area of one coastal state in potential overlap with that of one or several neighbouring states. In such cases, the delimitation of the bilateral continental shelf boundaries will be a matter between the states involved; the CLCS has no competence or mandate to settle bilateral boundaries. The CLCS will only consider submissions regarding potential overlapping areas in cases where the Parties involved give their consent in writing. In most cases, such consent is given on the basis of mutual agreement that the Parties will revert to bilateral delimitation negotiations when the final recommendations of the CLCS are issued (e.g. in the cases of Russia and Norway). In other cases, consent is given on the basis of up-front agreements or treaties regarding the bilateral boundaries in the potential extended continental shelf areas (e.g. in the cases of Australia with New Zealand, and Norway with Iceland and

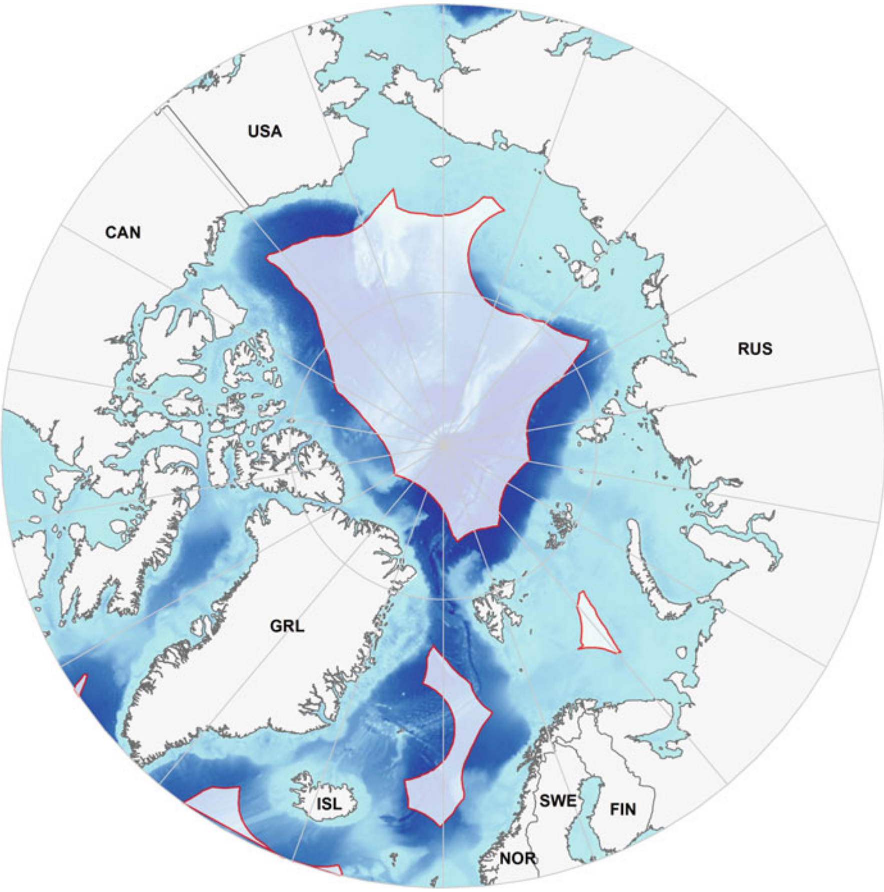

Fig. 18.1 Area beyond 200-mile Exclusive Economic Zones in the Arctic Ocean. Based on data analysed from OSDS [5]

Denmark/Faroe Islands). In cases where the Parties involved object to the submission(s) by their neighbour State(s), the CLCS will not consider the submission(s) and the process is blocked until the Parties comes to an agreement on how to proceed.

Article 76 provides two formulae a state may apply to determine how far the continental shelf extends. In addition, there are two rules that determine the maximum allowable extent of continental shelf. It is normally regarded in the interest of the state to extend its continental shelf as far out as the rules allow, so a state will combine the rules to its maximum benefit. The fundamental task in defining the extent of the continental shelf is to determine the foot of the continental slope. Foot of slope is at the base of the slope from whatever can be argued to be the continent down to where the slope starts to flatten towards the deep ocean floor (often at 3,000–4,000 m depth). The state may establish the outer limit at either 60 Nautical Miles beyond the foot of slope or at the location where the sediments thickness of

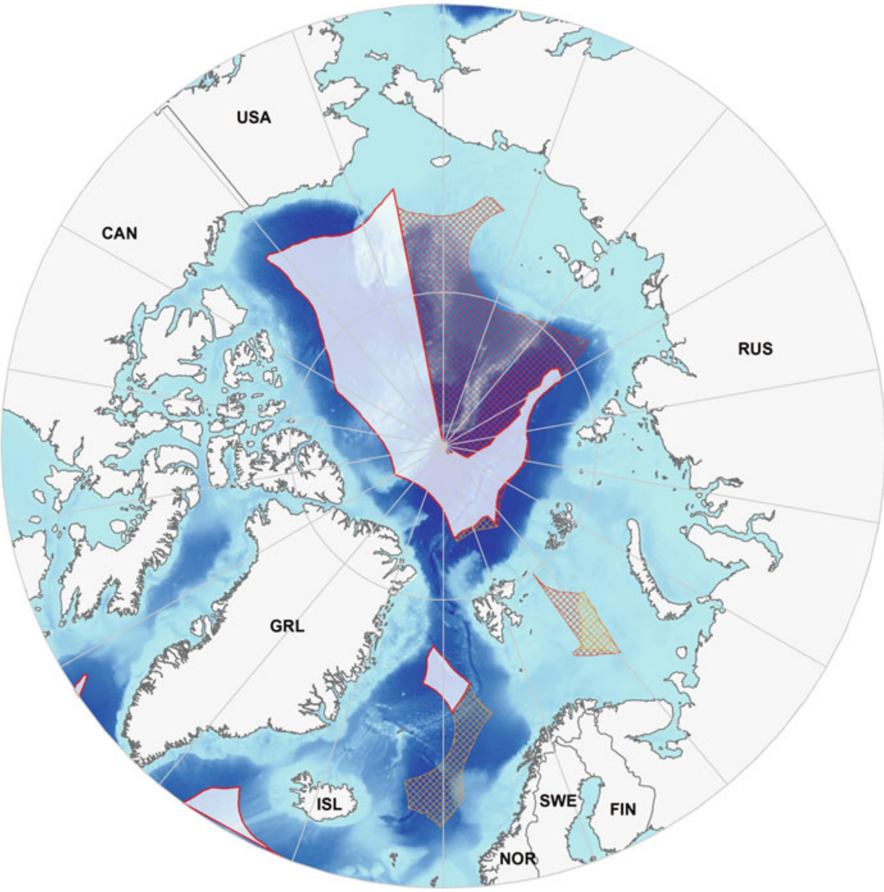

Fig. 18.2 Extent of Russian (*red*) and Norwegian (*orange*) submissions in the Arctic Ocean. Based on data analysed from OSDS [5]

the seabed is 1 % of the distance back to the foot of the slope. The latter rule obviously benefits states where the distant ocean floor has thick sediments.

The constraint rules determine how far seaward the formulae rules described above may be applied. The maximum is either 350 nautical miles from the baseline (coast) or 100 nautical miles beyond the 2,500-m depth line (the latter rule does not apply to ridges, like the mid-Atlantic spreading ridge), whichever is better for the coastal state.

18.3 Article 76 and the Arctic Ocean

To determine the extended continental shelf for the Arctic Ocean, one has to define the foot of the slope down from whatever could be argued as continental shelf, and apply the combined formulae and constraint rules to determine the final limits.

Almost all of the Arctic Ocean is surrounded by a wide, shallow continental shelf (Fig. 18.1). In addition, deeper parts of the Arctic Ocean are characterized by several ridges. From both a morphological and geological point of view the Lomonosov Ridge crossing from East Siberia to Greenland is indisputably of continental nature [4]. This is also the position taken by Russia in its submission in 2001. In accordance with article 76 one needs to search for the foot of slope on both sides of this ridge in combination with the foot of slope of the shallow shelves to find the outer limits of continental shelf in the Arctic Ocean. Since this ridge cuts the Arctic Ocean in two, there will be one potential area beyond the continental shelf of any state in the Eurasian Basin between Greenland, Norway and Russia, bounded by the Lomonosov ridge, and another in the Canadian Basin on the other side of the Lomonosov ridge towards Canada, Alaska, and East Siberia.

The Canadian Basin has very thick sediments, while precise thickness data is required for a submission, available global gravimetric and other data [2] is sufficient to argue that the sediments are thick enough to make the whole basin part of the continental shelf using the sediment rule. Both Canada and the United States are working hard to collect seismic data to give absolute evidence for this. Thus the only part of the Canadian Basin that does not belong to any of the surrounding states will be what falls outside both the maximum limits as applied by the respective countries. In Fig. 18.3 “the Area” in Canadian Basin is calculated based on the maximum rules of UNCLOS Article 76, using a combination of best available open source bathymetric and coastal baseline data. The result indicates there is only a very narrow area that will fall outside the combined maximum limits and thus define “the Area” for this part of the Arctic Ocean. Future bathymetric data north of this “hole” may even close this gap. Our estimation of “the Area” in the Canadian Basin is quite smaller than the result published by the International Boundaries Research Unit in Durham [3]. However, the size of this area beyond national jurisdiction is not relevant to the current discussion as long as it is small, or even non-existing, as indicated by either of these two analyses.

For most of the Eurasian Basin the foot of the slope and outer limit lines have already been defined in the submissions made by Norway and Russia.. Because of the active slow spreading ridge in this basin it has thin sediments and the “sediment thickness rule” of UNCLOS Article 76 provides fewer options for a considerably extended continental shelf. This leaves a much larger area outside the extended continental shelf of Russia and Norway (Fig. 18.2) and one can expect a similar outcome when Denmark / Greenland submit their data in a few years. In Fig. 18.3, the outer limit for Greenland is estimated based on a possible foot of slope, which most likely is close to what will be the final outcome of ongoing submission work by Denmark and Greenland.

At present, in the Arctic, only the Norwegian submission has been accepted by the CLCS but the general picture of what will be “the Area” in the Eurasian Basin is already very clear (Fig. 18.3). The only dramatic changes to this picture will occur if a state, for some reason, chooses not to “claim” areas it may have the right to define as its own extended continental shelf. Russia will submit new data in the near future while Denmark /Greenland, followed by Canada, will provide submissions in a few years. The US, even without having ratified UNCLOS, is conducting the necessary work in collaboration with its Arctic neighbours.

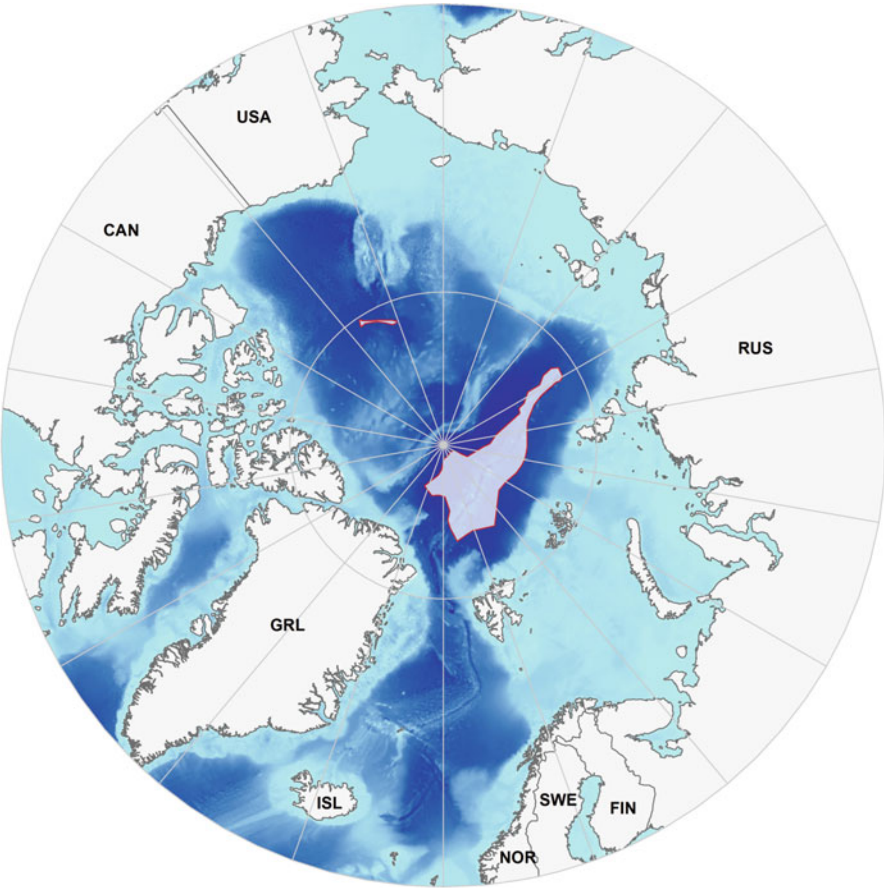

Fig. 18.3 Best estimate of "the Area" in the future, falling outside all possible future submissions in the Arctic Ocean. Based on data analysed from OSDS [5]

As a conclusion it is fair to predict that there will be seabed areas in the Arctic Ocean outside the continental shelf of any state approximately as given in Fig. 18.3. Those will then become part of "the Area" and any resource exploitation would be managed by the ISA. It is also evident that the non-state controlled portion of the Arctic Ocean seabed will be relatively small and that we may face a future where basically the whole Canadian Basin belongs to some state or another.

18.4 The Arctic Ocean Seabed: Who Is the Owner?

With the long history of cooperation in the Arctic there is reason to believe that the states surrounding the Arctic Ocean will prefer to submit their outer limits to the UNCLOS and use that mechanism to define what is outside the continental shelf of

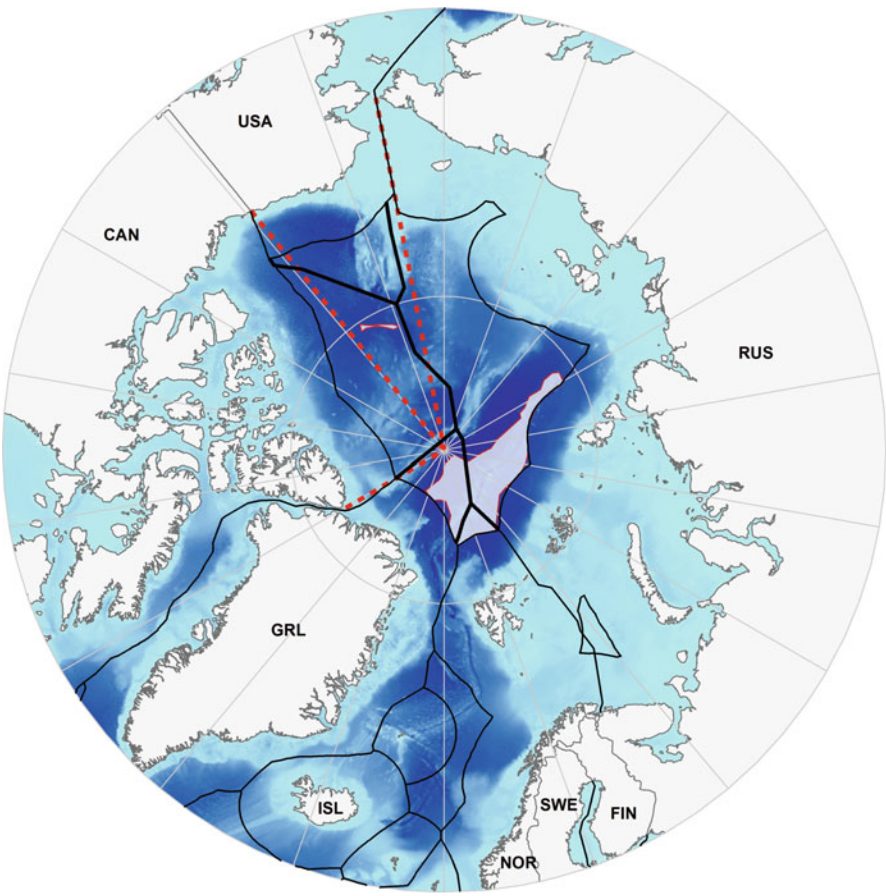

Fig. 18.4 Sector line model (*dashed red*) and mid lines (*black*) for area outside present Exclusive Economic Zones in the Arctic Ocean. Based on data analysed from OSDS [5]

any state, while they most likely will choose to agree to disagree on where the mutual boundaries will be and resolve that matter separately.

As an experiment, one can play with different models of alternative future boundaries between the states. The extreme models might be (a) to follow sector lines to the North Pole point or (b) use the midlines, the most common rule in limiting territorial seas between states. Sector lines are simply to follow the longitude lines of the globe to the north pole, midlines are constructed as the equidistant line between coastlines of states on either side. Figure 18.4 shows these two alternatives, and the map provides room for a few very important observations:

- Areas of potential dispute (the difference between sector line and mid lines) are relatively small compared to the areas where there is no reason to expect a dispute.

- Disputed potential conflict area around the north pole most often addressed in media and science literature is a small area, where Greenland, Canada, and Russia might choose to have overlapping claims. The total size of potential conflict space is much less than the area recently resolved between Russia and Norway.
- Largest area of potential disagreement may be between Canada and the United States. Interestingly enough, Canada would benefit from a midline principle, which is the opposite of the position Canada has toward the United States in the Beaufort Sea in the ongoing dispute with the USA inside the EEZ.
- Between the United States and Russia there is the potential of "no man's land" (i.e. it becomes part of "the Area") if the United States chooses principally to stick to mid-lines and Russia remains firm on its present submission border.

18.5 The Arctic Ocean Seabed: Worth Fighting Over?

In 2008, the United States Geological Survey released an updated assessment of oil and gas potential for the whole Arctic [9]. It confirms earlier expectations that the Arctic holds considerable undiscovered hydrocarbon resources now estimated to be some 22 % of the remaining undiscovered resources globally.

Superimposing the potential future border map (Fig. 18.4) on the USGS resource probability map [9], Fig. 18.5 reveals some simple observations:

- Most resources in the Arctic are actually within the EEZ of sovereign states.
- Almost all potential hydrocarbons, even outside EEZ, are within areas that will likely be controlled by a sovereign state assuming the application of UNCLOS article 76.
- Areas where there is potential dispute between states hold little or no expected hydrocarbons.
- Areas that in the future may be managed by the International Seabed Authority have limited potential for significant hydrocarbon reserves.

18.6 Conclusion

From this evaluation it is fair to state that all media coverage arguing for hydrocarbon driven conflict and a race 'for the North Pole' is – to put it mildly – exaggerated. It may however be noted that "the Area" may hold both bio-resources and minerals particular linked to the slow spreading ridge [6] but at the moment there is no evidence that exploration of such resources will be preferred in the Arctic Ocean over similar resources on the seabed elsewhere.

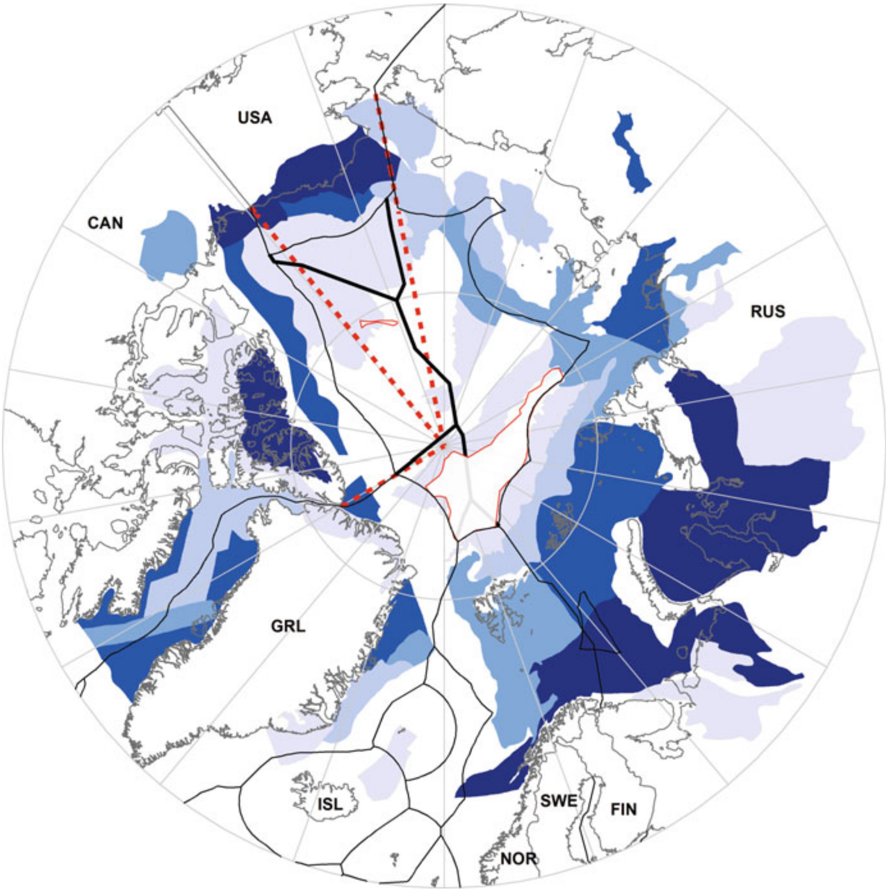

Fig. 18.5 Sector line model (*dashed red*) and mid lines (*black*) for the Arctic Ocean superimposed on the USGS [9] hydrocarbon probability(five probability classes with *darkest shade of blue* representing 100 % probability, and thereafter 50–100 %, 30–50 %, 10–30 % and less than 10 % represented with lightest shade of blue)

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Chapter 19
Cooperation or Conflict in the New Arctic? Too Simple of a Dichotomy!

Rob Huebert

Abstract Throughout the 1990s the Arctic had transformed into a region of peace and cooperation from being a zone of conflict and competition throughout the Cold War. However, the early 2000s new developments have begun to complicate the relationships between the Arctic states. Scientists and Northern Peoples began to discover that the Arctic was warming and the ice was melting. Arctic maritime boundaries were redrawn as the result of an international treaty. In addition; a growing number of resources were discovered in the region. As a result of these changes, debate emerged about the possibility of conflict in the Arctic. New security realities suggest that the Arctic could become a zone of security and military activity, rather than remaining a region of peace and cooperation. Ultimately, the Arctic Ocean is increasingly becoming an ocean like any other ocean. It will increasingly be used like all other oceans. Thus, it will increasingly see an increase of activities that may involve both cooperation and conflict. This paper will examine this increasingly complex Arctic security environment. While leaders of the arctic nations, (as well as a number of non-arctic) have issued statements promising peace and cooperation in the region, it is telling that many of the Arctic states are allocating substantial funds to improve their Arctic combat capabilities. Although currently there are no obvious flashpoints in the region, the willingness of these states to spend suggests that they are beginning to worry that the region will not remain an era of cooperation forever. But the question remains as to what *will be* the future nature of the region.

R. Huebert (✉)
Centre for Military and Strategic Studies, University of Calgary,
2500 University Drive, Calgary T2N 1N4, AB, Canada
e-mail: rhuebert@ucalgary.ca

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19.1 Introduction

Throughout the 1990s appeared that the Arctic had truly transformed into a region of peace and cooperation. Both the Cold War and the use of this region for military purposes had ended [23]. At the same time, due to the extreme existing climatic conditions, there was little economic activity in the region. Other than the northern indigenous populations, very few could function in the very cold temperatures. However, the early 2000s brought a period of change. Scientists and the Northern Peoples began to discover that the Arctic was warming and the ice was melting [1]. Arctic maritime boundaries were redrawn as the result of an international treaty that was negotiated in the 1970s and finalized in 1982 [21]. And a growing number of resources were discovered in the region.

As a result of these changes, debate emerged about the possibility of conflict in the Arctic. News stories increasingly began to raise the possibility of disputes arising over new resources and new boundaries in the Arctic. New security realities suggest that the Arctic will become a zone of security and military activity, rather than remaining a region of peace and cooperation. The effort to understand the newly emerging security environment is complicated by the reality that many of the military forces are deployed in the Arctic region for Arctic specific requirements. The Arctic Ocean is increasingly becoming an ocean like any other ocean, in that it will increasingly be used like all other oceans, such as for military purposes. Accordingly, the coastal Arctic states are taking steps to improve their military capabilities in the region which complicates any effort to understand the international nature of peace, security and conflict in the region.

This paper will examine the increasingly complex Arctic security environment. While leaders of the arctic nations (as well as an increasing number of non-arctic nations that are shown increasing interest in the region) have issued statements promising peace and cooperation in the region, expenditures in military capabilities suggest that the action is for security. In an era of increasingly strained economies, it is telling that many of the Arctic states are spending the funds necessary to improve their Arctic combat capabilities. Although currently there are no obvious flashpoints in the region, the willingness of these states to spend suggests that they are addressing serious security concerns.

19.2 The Transforming Arctic

The rapidity with which the Arctic is transforming poses one of the greatest challenges in assessing the changing Arctic security environment. The impact of climate change is most profound in the Arctic given the speed and complexity of the transformation. It is no longer an issue of if the ice cap will melt but when it will melt [16]. This melting is the most well-known evidence of physical change that has been recorded. The permafrost is melting; new precipitation patterns are developing;

and new ocean current patterns are emerging. In sum, the physical Arctic is changing in a way that it never has before.

As the Arctic melts it becomes more accessible. The accompanying perception is that the Arctic will become a zone of great resource potential. While some of this potential has already been realized, such as the development of diamond mining in Canada [15], the general expectation is that much more will soon develop. While new mineral sources for zinc, gold, iron ore and so forth are being found, anticipation is high for potential new sources of oil and gas. Studies indicate substantial reserves of oil and gas in the immediate offshore regions of the Arctic coastal states [22]. Further into the future the Arctic is also expected to provide new sources of energy through the development of gas hydrates and other nontraditional energy sources.

From an international perspective there is also significant transformation. The United Nations Convention on the Law Of the Sea (UNCLOS) provides for the development of new maritime zones of control. UNCLOS allows coastal states to extend some of their sovereign rights beyond the currently established 200 nautical mile Exclusive Economic Zone (EEZ). Article 76 provides for the rights of coastal states to establish their sovereign rights over the soil and subsoil of an extended continental shelf where it exists. Regarding the Arctic, it is suspected (though still uncertain) that this may allow coastal states to claim most of the seabed of the Arctic Ocean. The process to determine continental-shelf limits are well established within UNCLOS. All of the Arctic states have declared their confidence in the process and have declared their intent to proceed in a peaceful and cooperative manner. However, while Norway and Russia have submitted their claims, the Russian claim was returned for clarification; Denmark and Canada have yet to submit theirs; and the United States remains a non-party to the UNCLOS and hence cannot submit. Whether there will be any overlap in the various claims is not yet known.

19.3 Understanding the Transformation

The rate of transformation has been phenomenal. The pace and magnitude of the change has been difficult to understand, let alone what the changes mean. In fact, trying to understand the ramification of these changes has led to fundamentally different comprehensions of the Arctic amongst observers.

It is easy to understand why observers are confounded by the variety of opinions and assessments regarding the nature of the international security regime in the Arctic. Many press stories have emphasized a potential race for resources.[1] The underlying theme is that the coastal states will increasingly be in conflict over newly found Arctic resources and over boundary disputes.

At the other end of the spectrum is the formal position taken by the leaders of most Arctic states and most international legal scholars. These groups once posited that

[1] It is only necessary to search the internet for "Arctic security" to see at any given time, a wide array of stories examining the potential conflict that may arise in the Arctic. Interestingly, there has not yet been a study on the media reporting.

there is no threat of conflict. This was based on the argument that the resources and utilization of the region is well managed and proceeding in a cooperative manner.

The potential for conflict is predicated on the fact that historically there have been very few international regions that have remained conflict-free where large amounts of resources have been discovered in an area with uncertain international boundaries. With the possible exception of the North Sea, most regions with substantial resources in complex international areas are areas of heightened tension. This is one reason why the media is focused on conflict in the Arctic. The second reason is the strong rhetoric that is used by some leaders [8,18]. While none of the Arctic leaders have consistently used belligerent terminology in their comments about the Arctic, there is just enough negativity for the media to seize upon specific statements. And third, certain actions, such as the planting of a Russian flag at the North Pole, carry powerful nationalistic symbolism and fuel the focus on potential conflict [4]. This makes it relatively easy for the media to develop storylines focusing on potential conflicts and tensions.

However, many of the Arctic leaders, as well as members of the international legal academic community, have made a concentrated effort to show that focusing on conflict is mistaken and counterproductive. Almost all of the Arctic leaders have asserted a commitment to the development of a cooperative international regime. In May 2008, the five Arctic states (Canada, Denmark, Norway, Russia, and United States) bordering the Arctic Ocean met in Greenland and signed the Ilulissat Declaration in which they affirmed their commitment to accept the international maritime regime provided by UNCLOS, as well as committed to peacefully resolve any differences they may have regarding new maritime boundaries [11].

A concentrated effort has been made to resolve many of the outstanding disagreements that have lingered in the Arctic region. The best known example is the resolution of the maritime dispute between Norway and Russia in their Arctic EEZs [7]. Likewise, Canada and the United States have begun to discuss the resolution of their boundary disagreement in the Beaufort Sea [3]. Canada, the United States and Denmark have also cooperated closely in developing their scientific positions regarding their respective claims for an extended continental shelf. Overall, a determined effort has been made to cooperate regarding existing boundary disputes.

At the same time, a consensus has developed amongst many international legal scholars that the Arctic is developing in a cooperative manner that is at odds with the narrative that is portrayed by the media.[2] This is focused on the positive statements of leaders and on their efforts to use existing international rules and procedures to determine the new legal spaces in the Arctic. Specifically, the Arctic five's commitment to employ provisions of UNCLOS is viewed as concrete evidence that the regime is indeed developed in a cooperative fashion.

To an outside observer, the wide dichotomy of the developing Arctic security environment can be very confounding. Yet there is a certain commonality in both

[2] While it is too soon to be able to cite a critical bibliographic review, this trend stands out at most international conferences on the topic of the international legal regime in the Arctic.

perspectives. Both are focused on how new and existing maritime boundaries will be determined within the Arctic Ocean as it melts. The focus is clearly on utilizing the resources found within the zones. This includes the development of oil and gas resources, mineral resources, fish, tourism and international shipping. Will the development of these resources in the 'new' Arctic be conducted in a peaceful and cooperative fashion, building on established rules and agreements, or will the resource potentials in newly emerging maritime zones lead to tension and conflicts? The answer to this question really determines whether the international lawyers or the media are to be believed.

Determining and assessing the viewpoints of these conflicting narratives would be relatively straightforward if the development of resources was the only factor that needed to be considered. Unfortunately, the issue of cooperation or conflict in the Arctic region has become much more complicated. It is no longer only about the determination of maritime boundaries and the utilization of resources therein. In the last decade new security realities have begun to emerge in the Arctic.

19.4 A New Arctic Security Regime?

Despite the rhetoric of cooperation, Arctic states are making decisions to use considerable resources to reinvest in their Arctic combat capabilities. Second, most Arctic states are also reinstituting operations in training exercises in their high Arctic regions, which had largely been discontinued at the end of the Cold War. Third, most Arctic states have also begun to temper many of their statements regarding cooperation with additional statements vowing to protect their unilateral Arctic interests [10].

While no Arctic state is preparing for direct conflict in the region, all are beginning to take the security requirements of the region much more seriously. The motivations of the arctic states are mixed, and in many instances go beyond the Arctic region. There is no doubt that the Arctic states are much more interested in protecting their new zones of responsibilities, but in the case of Russia and the United States their Arctic regions are beginning to reemerge as sectors of importance for operations elsewhere. But as the Americans and Russians reestablish and expand their specific combat capabilities in their regions, their neighbors are left with the dilemma of how to respond.

The Russians must use their northern regions to support their nuclear deterrent. While the entire Soviet fleet literally rusted in harbour following the end of the Cold War, the Russian economic resurgence post-1990s allowed them to begin to rebuild their submarine force. They built new submarines and refurbished some of their older submarines, including both their attack submarines (SSN) and nuclear missile carrying submarines (SSBN) [14]. They also deployed submarines into the Arctic Ocean farther than they did throughout the 1990s [20]. This is partly in accordance with their need to maintain a nuclear deterrence based on their submarine forces, and in part to reestablish their emergence as a major military power in the region.

The reentry of the Russian submarine force into the Arctic has not gone unnoticed. The United States Navy has also begun to reenter the region. While their newest attack submarine – the Virginias – (SSN) were not intended to be Arctic capable [6], the American navy began to deploy and to publicize the entry of their most modern submarines into the Arctic in 2010 [12]. Likewise, the French navy has announced that it too is now engaged in Arctic exercises [5] as is the British navy [9]. Thus, the Arctic is beginning to resume its role as an important strategic transit point and, perhaps, operational location for nuclear-powered submarines in a fashion that echoes the Cold War.

The Arctic is also resuming its position as an operational area for the most advanced elements of the Arctic states' aerospace capabilities. The United States Air force has already deployed close to 20 % of its entire F-22 fleet to Alaska. Both Canada and Norway have announced that they will be purchasing advanced F-35 aircraft. While these aircraft will have functions well beyond Arctic operations, the Arctic is an important consideration in the purchase of these aircraft for both nations. The Russians resumed long-range bomber patrols over the Arctic Ocean in August 2007 [19]. They have also announced that they will be building a new long-range stealth bomber that will allow them to continue their long-range bomber patrols in the Arctic [13].

These are but a few of the very substantial new military capabilities that are now being developed and deployed in the region. In an era of substantial economic difficulty for most Arctic states, it is indeed telling that such high expenditures or proposed expenditures are now being made. It is highly unlikely that any Arctic state's government would consider such expenditures unless it believed it to be essential. The question is what it would be essential for?

What is driving these actions? First, all of the Arctic states recognize that as the Arctic Ocean melts they will need to protect their interests in the region, such as missions associated with search and rescue, environmental protection, fishery protection, or illegal activity. The military and the coast guards of the region will need to respond to the heightened use of the region. It is worth noting that several Arctic states have already faced tension and conflict regarding their resources in non-Arctic regions. The United Kingdom, Iceland, Canada, Spain, Norway and Russia have all used or threatened to use force against the nationals of the other side and, in some instances, against each other. There is no reason to automatically assume that the Arctic will be any different.

Second, the Arctic will increasingly be used as a strategic location for the submarine forces of the major powers. It is entirely possible that as the Chinese navy continues to expand, its nuclear-powered submarines will join the other four powers that already send their submarines to the region. When this happens, it will be interesting to watch the Americans and Russians' reaction.

Third, the Arctic will provide an increasingly important strategic transit point for the United States and possibly Russia. For example, given conflict in the Korean Peninsula or in East Asia in general, the Americans will use their military bases in Alaska to engage potential enemies. This will not be a war in the Arctic, but a war *from* the Arctic. Furthermore, should any Asian country ever fire a long-range ballistic missile at the United States, they would be engaged and intercepted by the American missiles at the ABM bases at Fort Greely, Alaska.

Fourth, any Russian intervention similar to its involvement in Georgia would probably drive both Sweden and Finland closer to NATO, with the possibility of full membership. Russia could find that a decision to use force as it did in the conflict in Georgia could extend NATO right up to its northern borders. This would undoubtedly continue to fuel Russian fears of encirclement, which in turn would affect other areas of cooperation in the region.

Fifth, it also needs to be acknowledged that what is now occurring is not a "new" security regime but rather is simply a resumption of the 'old' Cold War hostilities. It is possible that the differences created by the close geopolitical proximity of the Russia to the United States have never really ended. The end of the Cold War created an illusion of cooperation between the two powers that was amplified by the economic and strategic collapse of the Soviet Union. Thus the lack of interaction between the two states took on the appearance of cooperation. As soon as the Russian state improved its economic standing, the ongoing differences between these states in the Arctic have begun to reassert themselves. If this is true, then the Cold War in the Arctic has never really ended, it only was paused. Thus as Russia is able to begin rebuilding its military, with the necessity to place some of the new systems in the Arctic, it is inevitable that the United States would respond.

19.5 Conclusion

In total, states are not preparing to go to war over resources, either real or potential, in the Arctic. However, they are also not prepared to declare the region a zone of peace nor to reduce or eliminate their military capabilities as they did in the 1990s. The Arctic is becoming a more important region. Powerful and important military states have core interests in the region, and many of the smaller states are becoming concerned about new military actions that are being taken in the region. While most do not like to talk about the potential of returning to the 'bad old days' of the Cold War, it does seem premature and perhaps naive to accept the notion that the Arctic will be a zone without conflict or tension. The Arctic Ocean is becoming more like an ocean like any other ocean. The question that arises is which ocean? Will it be like the North Atlantic? A zone of cooperative commerce where there is a clear set of rules established to allow for all to operate fairly. Or will it resemble more of the East China Sea, where the same rules exist but take place in an atmosphere of increasing competition and distrust is increasingly developing? This still remains uncertain. What is certain is that the isolation of the Arctic Ocean will no longer isolate it from the greater international issues surrounding it. Perhaps the best hope to ensure that relations remain positive and cooperative is to honestly and critically examine why the Arctic states are doing what they are from a security and military perspective in the region.

The challenge will be determining how this is to be done. The Arctic Council is formally forbidden from discussing *"military security"* issues [17]. Since the Council is not a treaty organization this could conceivably be changed if the members felt that there was a political willingness to discuss security issue. But there has been no appetite among its members to do this. The closest that it has come to any topic relating to security has been the creation of a search and rescue agreement that was only very recently agreed to. It will require some of the states to engage their military forces to coordinate search-and-rescue activities [2]. But since for many of members, their assets are under civilian control, this agreement represents only a small step in coordinating defence policies and actions. It remains unlikely that the Council will move anytime soon into a forum that is willing to discuss other defence related issues.

Could a NATO-Russia Council then prove useful? Five of the Arctic states are members of NATO (i.e., all of the Arctic coastal states except Russia), and two – Finland and Sweden – are moving closer to the organization. So it is conceivable that there could be some form of agreement to move Arctic security issues to this forum or something similar. But would Russia be comfortable in such an arrangement or would it see such an effort as encircling? But such a body, if created, could provide a means to develop confidence building means to ensure that misunderstandings do not hurt cooperation. But such a body would have a limited usefulness in addressing tensions and conflicts that 'spill' into the Arctic from other regions. Minimizing the problems that will flow from other regions remains the biggest challenge facing an Arctic that is seeing substantially new military capabilities. There are no easy and clear solutions to that new reality.

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Chapter 20
The Security Implications of Climate Change in the Arctic Ocean

Kristian Åtland

Abstract The dramatic changes currently taking place in and around the Arctic basin – ice melting, sea level rise, permafrost thaw, coastal erosion, etc. – are likely to have a major impact on the security situation of the Arctic coastal states, as well as that of outside actors, in the coming decades. The changes raise not only environmental security concerns, but also secondary concerns related to the dynamics of Arctic interstate relations. In some scenarios, climate change may serve as an "instability accelerator" and aggravate tensions between states over issues such as the access to offshore oil and gas resources, living marine resources, and shipping lanes. This is not to say that a "remilitarization" of the Arctic Ocean to be expected, or that the Arctic is more conflict-prone than other regions. The link between climate change and conflict is far from self-evident. There are many other intervening variables, such as the role of regional institutions, governments, and social actors in managing the process of environmental change, mitigating resource pressures, and containing potential tensions.

20.1 Introduction

The effects of global warming on the physical environment of the Arctic are already very much in evidence. The melting of the polar ice cap is opening up previously inaccessible parts of the region to ship traffic and resource exploration, and issues pertaining to boundaries and maritime jurisdiction in the Arctic Ocean and its adjacent seas are rapidly coming to the surface. The purpose of this chapter is to shed light on the multifaceted security implications of climate change in the Arctic

K. Åtland (✉)
Norwegian Defence Research Establishment,
P.O. Box 25, Kjeller N-2027, Norway
e-mail: kristian.atland@ffi.no

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Ocean. This is a topic that has received significant political and scholarly attention in recent years, particularly after the publication of the Fourth Assessment Report of the United Nations Intergovernmental Panel on Climate Change (IPCC) in early 2007. The issue of climate change, and its long-term implications for regional stability, has also been squarely placed on the policy agendas of NATO and the European Union.

The circumpolar coastline of the Arctic Ocean is 45,389 km long. Five states – Russia, the United States, Canada, Denmark, and Norway – have a direct coastline on the Arctic Ocean, whereas the remaining three Arctic states – Sweden, Finland, and Iceland – do not. None of the Arctic coastal states envisage a comprehensive, region-specific legal regime similar to that of Antarctica under the Antarctic Treaty [3]. Rather, they see the United Nations Convention on the Law of the Sea [25] as the basis of their policy towards the region. All of the Arctic coastal states have signed the Convention, and all but the United States have ratified it. They all emphasize the necessity of resolving jurisdictional disputes in a peaceful manner, through bilateral and multilateral negotiations and in correspondence with UNCLOS procedures.

This does not mean that there is no potential for tensions, disputes, and conflicts in the Arctic. In recent years, a number of observers have expressed concern that growing rivalry over access to natural resources and emerging new shipping lanes may lead to conflicts between two or more of the Arctic coastal states, or between Arctic and non-Arctic states. Others are more concerned with the formidable environmental security challenges that face the region and those who inhabit it. Seen from a conceptual standpoint, *environmental* insecurity is different from *military* insecurity. As pointed out by Daniel Deudney [9], Barry Buzan [6], and Richard Moss [20], there are many arguments against "securitizing" the issue of environmental degradation. Threats to the environment are usually unintended, and often transcend national boundaries. They have to be dealt with in a collective manner, and usually by non-military means. Placing environmental security challenges in the same category as military security challenges may complicate – rather than facilitate – their prevention. On the other hand, there is no denying that environmental change may be a driver of social destabilization and intra- and interstate tensions [18, 24]. The key question here is not whether the issue of environmental change deserves the attention of researchers and policy-makers, but whether it should be treated as a *security* issue.

A central but frequently neglected sub-question in this regard is whether the impact of climate change on global, regional, national, or human security is *direct* or *indirect*. Some tend to see climate change as a security issue in and of itself (because it threatens the nature environment, and ultimately the existence of the human race), whereas others are more concerned with the role of climate change as a potential driver of intra- and inter-state conflicts (because it may serve as a "multiplier" of other threats and lead to regional instability and violent conflicts).

The latter perspective, focusing on the *indirect* effects of climate change on regional security dynamics, seems to have gained in prominence in recent years, partly at the expense of the former, which is more general in orientation and inherently difficult to operationalize for security analysts and political decision-makers [17].

Examples of indirect effects of climate change on international peace and security include alterations in regional and global patterns of migration, and disputes over access to natural resources in various parts of the world, including the “global commons”, meaning areas outside national jurisdiction.

20.2 Rising Temperatures = Rising Tensions?

While recognizing the severity of the challenge and the need for adequate countermeasures, we should not jump to conclusions about the security implications of climate change, or the relationship between climate change and armed conflict. The German Advisory Council on Global Change (WBGU) has identified a number of potential “conflict constellations”, induced or enforced by climate change through mechanisms such as degradation of freshwater resources, decline in food production, extreme weather events, environmentally induced migration, and so on [24]. Similar indirect causal connections between climate change and violent conflict have been identified in other recent studies [4, 21]. However, as pointed out by Idean Salehyan [23], there is no “consensus” among scholars that climate change causes conflict, regardless of other factors. The effect of climate change on armed conflict seems to be contingent on a number of political and social variables which, if ignored by analysts, can lead to poor predictions about when and where climate-induced conflict is most likely to occur, and how.

In order to obtain a better understanding of the relationship between climate change and conflict, we need to explore the interplay between climate change and other factors that may cause intra- or interstate tensions. Highly relevant in this regard are the political, economic, and social characteristics of the country or region in question, and the role of potentially “stabilizing” factors such as international law and multilateral governance and institutions. Statistically, societies that are economically developed and politically stable are better equipped to handle climate-induced environmental change than societies that are characterized by other conflict-prone features such as “bad governance, large and heterogeneous populations, social inequalities, bad neighborhood, and a history of violence” [5]. Thus, regions that are politically unstable to begin with, e.g. sub-Saharan Africa, may experience far more severe consequences from climate change than politically stable, sparsely populated, and generally well governed regions such as the Arctic.

That being said, it should be noted that climate change *under certain conditions* may lead to rising tensions also in the northernmost part of the globe. The region’s growing economic significance, combined with the presence of a number of unresolved issues of international, and particularly maritime, law, adds to the long-term conflict potential in the region. Thus, climate change may act as a “threat multiplier” also in the Arctic [8, 10]. As the ice cover recedes, the region will become more accessible to state and non-state actors, and commercial activities such as fisheries, petroleum extraction, marine transportation, cruise traffic, and so on, are likely to increase. This may in turn place new demands on the ability of Arctic states to maintain regional stability.

Simply put, the long-term interstate conflict potential in the Arctic can be divided into three main categories: (i) conflicts over access to petroleum and mineral resources on the Arctic continental shelf; (ii) conflicts over access to renewable marine resources in the northern waters; and (iii) conflicts over access to Arctic shipping lanes. Dynamics within each of the conflict categories listed above are likely to be affected, directly or indirectly, by the process of climate change. They are therefore well worth a closer look.

20.3 Conflicts over Access to Petroleum Resources

In March 2008, the European Union published a report entitled *Climate Change and International Security*, which, inter alia, touches on the topic of climate-induced resource conflicts in the Arctic. In the report, the European Commission and its High Representative for Foreign and Security Policy argue that "the increased accessibility of the enormous hydrocarbon resources in the Arctic is changing the geo-strategic dynamics of the region with potential consequences for international stability and European security interests". This development is "illustrated by the recent planting of the Russian flag under the North Pole". The report calls attention to "the intensified competition over access to, and control over, energy resources", and maintains that "there is an increasing need to address the growing debate over territorial claims [in the Arctic]" [10].

The United States, on its part, has used the potential for resource-related conflicts in the Arctic as an argument in favor of strengthening the US Navy. In a "Cooperative Strategy for 21st Century Seapower", published in October 2007, it is argued that "climate change is gradually opening up the waters of the Arctic, not only to new resource development, but also to new shipping routes that may reshape the global transport system". These developments may offer new opportunities for economic growth, but they are also, in the words of the Strategy, "potential sources of competition and conflict for access and natural resources" [27].

Concerns that rivalry over access to Arctic petroleum resources may lead to increasing interstate tensions are also common in the Russian political discourse. For instance, in July 2007, shortly before the Russian North Pole expedition, the former director of a Moscow-based foreign policy think tank, Dr. Vladimir Frolov, published an article in the *Russia Profile* magazine entitled "The Coming Conflict in the Arctic". In this article, he argues that "Russia needs to find new sources of fuel" and that "the Arctic seems like the only place to go". The fact that international law does not recognize Russia's right to the entire Arctic seabed north of the Russian coastline is described as a "problem", and the United Nations' non-acceptance of previous Russian claims in the region is largely blamed on the United States. The United States is, in Frolov's terminology, "jealous of Russia's attempts to project its dominance in the energy sector", and potentially disposed "to intrude on Russia's home turf" [11].

Statements such as these may indicate that there is a tendency among several of the Arctic states to regard their northern neighbors as potential "rivals" and "competitors" in the quest for oil and gas resources on the Arctic continental shelf. It is also possible that current legal disputes in the region may acquire increasing significance in the period up to 2030, possibly leading to an increase in the coastal states' military presence in the region. But to suggest that interstate "resource wars" are looming in the horizon seems somewhat far-fetched. In all of the states concerned, the use of military force is seen as a last-resort option, and even though the stakes are high, most international powers would prefer to play by the rules of international law, since failure to do so would alienate the sympathy of foreign investors.

As Barry Zellen points out in his latest book, military power will continue to have its place in the region, and to some extent determine the availability of resources. But in the most likely scenario, "it is science that will define the new boundaries" [29]. Uncertainty and disagreements over borders and jurisdiction on the Arctic continental shelf may be gradually replaced by certainty and agreement, as the outer limits of each Arctic state's offshore domain are clarified through undersea mapping, agreed-upon legal procedures, and bilateral agreements. The Norwegian-Russian treaty on delimitation and cooperation in the Barents Sea and the Arctic Ocean [19], signed in Murmansk on 15 September 2010, may serve as a model for other delimitations in the Arctic region.

Some of the disputes may be more difficult to resolve than others, or just take a longer time to settle, but there seems to be more patience among the involved stakeholders than is generally recognized. One of the reasons for this is that most of the currently known and extractable oil and gas resources on the Arctic shelf are located in areas of *unchallenged national jurisdiction*. Economically as well as politically, it would make little sense for a country that has access to unexploited fields on land or in undisputed waters close to the shore to embark on costly offshore projects in disputed, and possibly ice-infested, waters far from the coast. Four of the five Arctic coastal states are UNCLOS signatories, and all of them take their legal commitments seriously, as stated in the 2008 Ilulissat Declaration [14]. The same goes for their collective "stewardship" responsibilities in the region.

However, when discussing the long-term conflict potential in the Arctic, one should also be aware of the potential for disagreements between the Arctic coastal states and the remaining three members of the Arctic Council (Iceland, Sweden, and Finland), and, perhaps more problematically, between Arctic and non-Arctic states. Should an "outside" actor such as China suddenly establish a significant presence in the region, for commercial, military, or other purposes, this could potentially lead to frictions with the established community of Arctic states [12]. The involvement of third-party actors in the exploration or exploitation of resources in disputed areas could also have a destabilizing effect on interstate relationships.

20.4 Conflicts over Access to Marine Resources

The Arctic seas contain some of the world's oldest and richest commercial fishing grounds, and fisheries constitute an important part of the economies of many, if not all, Arctic states. As documented in the Arctic Marine Shipping Assessment [2], fisheries are particularly extensive in the Norwegian and Barents Seas, and the eastern part of the Bering Sea. The long-term impact of climate change on fish stocks in these and other waters adjacent to the Arctic Ocean is hard to predict, but the most likely scenario is that the stocks will gradually move northwards as sea temperatures heat up. A study conducted by the U.S. Arctic Research Commission in 2002 concluded that "climate change is likely to bring extensive fishing activity to the Arctic, particularly in the Barents Sea and Beaufort-Chukchi region…", and that "Bering Sea fishery opportunities will increase as sea ice cover begins later and ends sooner in the year" [26].

A relevant question in this regard is how the northwards movement of fish stocks, possibly accompanied by a decline in stocks further south, will impact on interstate relations in the region and the relationship between Arctic and non-Arctic states. Fishery disputes may arise not only between neighboring coastal states, such as Norway and Russia in the Barents Sea (including the Svalbard Zone), but also when coast guard vessels act to protect the region's marine resources from extensive harvesting by boats from distant regions. Tensions may also arise when stocks migrate from the waters of one country into those of another, cf. the migration of Alaska snow crabs from traditional locations off the coast of Alaska towards Russia's northeastern coastline. A third category of challenges relates to the northward movement of fish stocks into areas of the High Seas that are unregulated by fishing quotas.

Historically, interstate disputes over access to marine resources in contested areas of the ocean are not a new phenomenon. Frequently cited examples of so-called "fish wars" are the British-Icelandic "cod wars" in the North Atlantic (1958–1961, 1972–1973, and 1975–1976), the Norwegian-Icelandic dispute over fisheries in the Svalbard Fisheries Protection Zone (1994), and the Canadian-Spanish/EU "turbot war" on the Grand Banks off Newfoundland (1995). In the North Pacific, Russia and Japan have had a long-standing dispute over fishing rights in the waters around the disputed Kurile Islands, occasionally leading to the use of military force. All of the clashes listed above included various forms of "extraordinary" measures being undertaken in the name of a state against one or more fishing vessels of another state. The list of measures that were taken includes the firing of warning shots, trawls cuttings, seizure of ships and/or crews, deliberate rammings, and live fire aimed at the hull of fishing vessels.

It should be noted, however, that fishery disputes rarely escalate to the level of sinking of ships and loss of life. Statistically, the use of military force in fishery disputes is rare, and when force is used, it is rarely reciprocated. In other words: Interstate fishery disputes rarely get "militarized", in the sense of leading to the exchange of fire between naval forces, and it can therefore be claimed that they in most cases do not "carry the implications of war" [28]. This is not to say that there is no potential for escalation of such disputes. Regulatory measures undertaken by one state, particularly in areas of unclear or disputed jurisdiction, may be interpreted by another state as biased and unjustified, and trigger countermeasures. As observed in other disputed maritime areas, such as the East and South China Seas, paramilitary or maritime constabulary forces may be more likely to experience force-on-force encounters than regular naval forces. Civilian vessels may also be more likely to attempt to evade arrest if confronted by paramilitary maritime forces [16].

The pressure against the renewable marine resources of the Arctic is likely to increase, partly as the result of global climate changes and resource scarcities in other parts of the world. This may lead to frictions not only between neighboring coastal states, but also between regional and outside actors. As water temperatures rise and the ice edge moves further and further north, the feeding areas of commercially important fish stocks are likely to follow suit, and so are the fishing fleets of Arctic as well as non-Arctic states. This will place heavy demands on the coastal states' ability to regulate the harvesting, hinder illegal, unreported, and unregulated (IUU) fishing, and prevent the escalation of interstate fishery disputes.

20.5 Conflicts over Access to Shipping Lanes

There are also a number of lingering disagreements between at least some Arctic states when it comes to the legal status of the two main maritime transport corridors through the Arctic – the Northwest Passage (through the Canadian archipelago) and the Northern Sea Route (north of Russia). The disagreements relate to issues such as the drawing of baselines, the outer borders of internal waters, the status of straits, and the right of transit passage.

According to the Arctic Marine Shipping Assessment [2], some 6,000 vessels of various categories visit the Arctic marine area annually. All but a few voyages take place on the periphery of the Arctic Ocean, where ice conditions are the most accommodating. Traffic is particularly extensive along the Norwegian west coast and in the Barents Sea, in the waters around Iceland and the Faroe Islands, southwest of Greenland, and in the Bering Sea. Ships travelling the Norwegian and Barents Seas include oil and LNG tankers, bulk ships, coastal ferries, fishing vessels, and cruise ships. There is also a sizeable traffic of ice-enforced tankers and bulk cargo carriers between Murmansk and Varandey on the Pechora Sea, and between Murmansk and Dudinka in Siberia.

Despite significant reductions in the summer sea ice extent, traffic volumes along these routes are still fairly modest, and the traffic is mostly destinational, rather than trans-Arctic. According to the Arctic Marine Shipping Assessment, this is likely to remain the situation in the foreseeable future [2]. But it is also possible to imagine scenarios under which trans-Arctic shipping becomes more attractive. In the coming decades, the sailing routes in question are likely to become ice-free for considerable parts of the year, especially north of Siberia and in the Russian Far East. This may lead to an increase in traffic volumes in the Arctic, particularly in the event of a destabilization of regions surrounding other strategic transit points such as the Suez and Panama Canals. Temporary or permanent increases in ship traffic in the northern waters may potentially heighten the risk of interstate conflicts related to the use of major Arctic marine transport routes, regional as well as trans-Arctic.

The Northwest Passage goes along the northern coast of North America, through the waters of the Canadian Arctic archipelago, around which Canada in 1985 drew straight baselines and simultaneously declared to be “internal waters” [13,22]. This view is not shared by the United States, which considers the passages in question to be “international straits” and subject to the freedom of navigation, for commercial as well as state vessels. The European Union seems to take a similar view. While not explicitly addressing the status of the waters of the Northwest Passage, the 1988 Arctic Cooperation Agreement between Canada and the U.S. stated that navigation by U.S. icebreakers in the waters claimed internal by Canada would take place with Canadian consent. As pointed out by Jessie Carman [7], the 1988 agreement temporarily stabilized the situation, but applied only to *icebreakers*, assuming that any commercial vessel operating in these waters would require icebreaker assistance. This assumption may not necessarily be true in the future. Climate change may at some point turn the Northwest Passage into a commercially viable route for non-supported transits, seasonal or year-round, and this may potentially lead to heightened tensions between Canada and the U.S., and/or between Canada and the EU. Additional sources of concern for the Canadians are the allegations that U.S. nuclear submarines may have transited unannounced through Canadian Arctic waters. In recent years, Canada has taken steps to strengthen its military and coast guard presence in the region, and in December 2009, the Canadian parliament voted almost unanimously in favor of a bid to rename the country’s Arctic seaway “the *Canadian* Northwest Passage.”

On the other side of the Arctic, Russia’s position resembles that of Canada. Russia has drawn straight baselines around Novaya Zemlya, Severnaya Zemlya, and the East Siberian Islands, rendering the waters between the Russian mainland and said islands to be internal waters. In fact, the entire “sector” between the Russian coastline and the North Pole is frequently described as Russian. Russian and Soviet legal experts have long claimed that the straits along the Northern Sea Route “cannot be regarded as being used for international navigation, since the entire history of Arctic exploitation knows only extremely rare individual instances of passage through them by non-Russian ships” [15]. They further note that straits that connect the Barents, Kara, Laptev, and East Siberian Seas are seen as part of “a special legal regime [that precludes] their uncontrolled used by foreign seafarers.” Other countries, most notably the United States, have questioned the Russian position and claim that the straits are international, and that the right of transit passage for foreign vessels exists.

In terms of distance, the Northern Sea Route offers significant savings compared to alternative routes between ports in Northwest Europe (e.g., Hamburg) and Northeast Asia/Northwest America (e.g., Yokohama, Hong Kong, Singapore, and Vancouver). For some destinations distance savings can be as high as 50 %. Distance savings would be even greater for traffic between Northern Europe (e.g., Northern Norway and the Kola Peninsula) and the Northern Pacific area (e.g., Alaska). For international shipping companies, savings in distance may lead to savings in time and money. An increase in traffic along the trans-Arctic sailing routes north of the Eurasian continent may not be good news for ports located in Southeast Asia or the Middle East, which would risk reductions in trade volume.

Still, as of today, there is considerable reluctance among foreign as well as Russian shipping companies to make use of Russia’s northern waterway, particularly as an inter-ocean route. As a rare exception, two German cargo ships from the Bremen-based Beluga Group, assisted by a Russian icebreaker, conducted a successful journey along the entire length of the Northern Sea Route in the summer of 2009. The journey went from east to west, and the vessels encountered very little ice throughout the transit. However, neither this nor other shipping companies have plans to start regular or year-round trans-Arctic operations. There is still too much uncertainty, which relates to factors such as the generally unpredictable ice conditions, the lack of infrastructure, lacking availability of search and rescue services, inter-state disagreements over the legal status of the waters and straits along the Route, insurance-related issues, and the terms and fees set by the Russian Northern Sea Route Administration.

In a more distant future, transits along sailing routes further from the coastline – north of the Russian islands and north of the Canadian archipelago – could become a reality. Such a turn of events could create a variety of new legal and safety concerns, very different from those that are associated with the current sailing routes. It could deprive Russia and Canada of much of their prestige and regulatory power, not to mention potential sources of income.

20.6 Meeting the New Security Challenges

Obviously, there are many uncertainties when it comes to how, how much, and how soon the process of climate change will alter security dynamics and security politics in the Arctic. What is clear, however, is that changes in the region's physical environment are likely to present policy planners and political decision-makers with a wide array of challenges that will require extraordinary measures at the national as well as at the regional and international levels.

At the *national level*, all of the states that surround the Arctic Ocean will work to secure their short-, medium- and long-term strategic and economic interests in the region. The region's new role as a potential energy province and transport corridor implies that the stakes are high for all of the involved parties. This may point towards an increase in the level of interstate tension. On the other hand, all of the Arctic states recognize the crucial role of international law, including UNCLOS, in the settlement of current and future interstate disputes over access to maritime and shelf areas in the region. Thus, even though the effects of climate change on ecosystems are likely to be more extensive in the Arctic than in many other places, the consequences for regional peace and stability may turn out to be less severe here than in many other parts of the world, such as sub-Saharan Africa.

At the *regional level*, institutionalized cooperation arrangements such as the Arctic Council and the Barents Euro-Arctic Council can play an important role in the maintenance of regional stability. These and other components of the multifaceted system of Arctic governance do not have the authority to make formally binding decisions on legal or other matters, but they are important arenas for interaction and cooperation among Arctic states on issues of common concern. For instance, by initiating regionally oriented academic studies such as the Arctic Climate Impact Assessment [1] and the Arctic Marine Shipping Assessment [2], the Arctic Council has drawn the attention of its member states and the outside world to emerging security and other concerns in the region, and created common understandings of possible ways to meet them.

Furthermore, it should be pointed out that the issue of climate change, and its security implications for the Arctic region, are to be dealt with also at the *international level*. The observed increases in air and water temperature in the Arctic and the melting of sea and glacial ice are not only regional, but also global security concerns. Processes taking place in the northern part of the globe are likely to affect the rest of the world in a number of ways, most notably through sea-level rise. The driving forces behind the process of global climate change will have to be addressed in a collective manner, and few organs are better equipped to coordinate the effort than the United Nations. The UN system can also assist the Arctic states in settling disputes. Most importantly, the Arctic states can draw on tools such as the Law of the Sea Convention, and increasingly relevant UN organs such as the Commission on the Limits of the Continental Shelf (CLCS) and the International Maritime Organization (IMO).

20.7 Concluding Remarks

This chapter has sought to shed light on various aspects of the process of climate change and its security implications in and around the Arctic Ocean. The direct and indirect impacts of climate change, and their consequences for political and military planning, are still not fully understood. Further research is needed. The dialogue between natural scientists and social scientists on the topic of climate change is still fragmented, and few social scientists have began to explore the vast amounts of data that natural scientist have provided for us in recent years. Similarly, natural scientists are not always aware of the aspects of the topic that social (e.g., political) scientists are most interested in, such as the “peace and conflict” dimension.

In recent years, it has become fashionable to talk about the Arctic in conflictual terms. The region is often described as an arena where states are preparing for a future “resource race”. However, as pointed out in the introduction, the link between climate change and conflict is far from self-evident, and there are many other factors that need to be taken into account, such as the role of governments, regional and international institutions, and international law. Even though there are a number of unresolved issues pertaining to borders and jurisdiction in the northern waters, they are not necessarily more complex or numerous than those in maritime areas of comparable size elsewhere in the world. By settling maritime disputes, strengthening regional cooperation arrangements such as the Arctic Council, and establishing “rules of the road” for shipping and offshore petroleum activities, the Arctic rim states can improve the prospects for a peaceful and politically stable Arctic, even in an era of environmental change.

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Part V
Arctic Ocean Infrastructure Considerations

Chapter 21
Global Change, Northern Transformations, and a Changing Socio-Economic Landscape

Joan Nymand Larsen

Abstract Global change processes, economic and geo-political transformations, and the increased integration of the Arctic region with global markets all affect important economic and resource strategic interests. The changing demand and supply conditions for Arctic commercial resources affect market as well as non-market economies of the North. Global change is projected to have substantial future impacts on renewable resources. At the same time it may reduce the opportunity to engage in traditional activities important to the identity and way of life of northern residents. Life in the Arctic is increasingly shaped or influenced by events, decisions and activities happening elsewhere, with the future of the Arctic linked to and influenced by other, non-Arctic regional, social, political and economic interests. Socio-economic challenges related to global change pressures can be expected to play a growing role in decisions on resource allocation, resource use, ownership and control, and with important consequences for Arctic economies and prospects for their future economic sustainability. Strategies for sustainable development and Arctic environmental protection need to consider the economic, social and environmental linkages between the Arctic and other regions of the globe.

21.1 Introduction

Global change processes, economic and geo-political transformations, and the increased integration of the Arctic region with global markets all affect important economic and resource strategic interests. The changing demand and supply conditions

J.N. Larsen (✉)
Stefansson Arctic Institute & University of Akureyri, Borgir, Norðurslóð, IS-600, Akureyri, Iceland
e-mail: jnl@unak.is

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for Arctic commercial resources affect market as well as non-market economies of the North. As widely documented, the melting of sea ice has direct consequences at many levels; it increases accessibility, reduces distance and costs of transport, and it affects accessibility and market demand in far distant places [2, 10, 15]. Global change is projected to have substantial future impacts on renewable resources – fisheries, stock of marine mammals, terrestrial ecosystems, and agriculture. At the same time it may reduce the opportunity to engage in traditional activities important to the identity and way of life of northern residents. The following offers some brief and preliminary reflections on Northern economic transformations, the drivers of change, and some of the challenges and options for the future of the North.

With the Arctic Ocean transforming to being seasonally ice-free, increased interest in the resource wealth of the North raises critical questions regarding the socio-economic prospects for the region's future, the level and direction of human development, and the emerging and changing nature of risks to the cultural stability of the peoples inhabiting the North. Smaller local communities, urban centres, and industrialized cities in the North all feel the effects of increasing global connections which have become key forces in shaping the path of socio-economic development in the North. Socio-economic developments in regions outside the North influence the Arctic, while developments in the Arctic are similarly affecting development in markets beyond the North. The strength and increased importance of these connections – reflected in the ever growing force of globalization and the expanding economic integration across market and non-market economies – has meant direct transmittal of global market volatility to the North and the region's narrowly resource-based local and regional economies. This leads to impacts on employment opportunities, the distribution of income and wealth, the allocation of resources, and local community livelihoods. These impacts may be further amplified when Arctic local communities are located in more resource-strategic positions that are particularly vulnerable to new activities competing for resources [20, 21, 25].

21.2 Economies of the North

Economies of the North have a number of common characteristics that set them apart from economies outside the region, and among these are their significant resource supplies. Oil, gas, and mineral exploration activities, for example, are projected to be among major drivers of social and economic change in the Arctic, and a direct source of conflict of interests between different arctic and non-arctic stakeholders regarding land and other northern resource use. In the north today the local economy can be described as a mixed economy where both market and non-market activities all play an important role in supporting community livelihoods [11]. Wage employment, traditional pursuits, and transfer income from government all provide important sources of income, with the relative size and importance of the market, non-market, and transfer sector varying throughout the region.

The formal and market-based economy is characterised by the growing role played by large-scale capital and skill-intensive industrial resource production, whereas the informal, subsistence based non-market economy is described by traditional pursuits of hunting, trapping, gathering, but with increased connections to the local market economy. Together these commonalities set the region apart from those beyond. At the same time, economies within the North vary significantly; by type, quality, and quantity of industrial resources produced; by the share of the indigenous population and the size and importance of the local economy; as well as by the different national economic and political systems [17, 22, 23]. Community viability increasingly requires the maintenance of economic relations with the outside. Yet, the strength of these economic relations and the linkages between different sectors differ significantly due to broad variations in physical, natural, financial and human resource endowments. For local communities where resource endowment is limited and connections to external markets are similarly limited or non-existent, only few, if any, alternatives may exist to their traditional way of life. Consequences of global change may be particularly damaging when compensation for negative economic impacts are not directly available. For some communities social problems may increase where traditional activities and subsistence harvesting has given way to increased marked based economic activity, and often with less reliable and less predictable employment.

Life in the Arctic is increasingly shaped or influenced by events, decisions and activities happening elsewhere, with the future of the Arctic linked to and influenced by other, non-Arctic regional, social, political and economic interests. The vast majority of Arctic commercial renewable and non-renewable resources are destined for world markets, and this places the circumpolar north firmly in the world system – a reality that is far removed from earlier periods' view of the high North as a hinterland region existing in relative isolation. The economic future of the Arctic is increasingly tied to the direction of economic and global change processes and the ability to mitigate the negative effects of resource supply shocks, changes in world prices of commercial resources, and the general economic volatility associated with limited economic diversification in the north [16, 18].

Global economics and natural resource availability are key drivers of transformations of the North. Rising global demand and an increased desire for stable and secure resource supplies, mean that resource activities in the Arctic will likely continue to expand, and perhaps despite any observed and expected physical, environmental and human costs. Socially important environmental changes result not simply from climatic change, but from interactions between climate, ecosystem, and resource usage [13]. Environmental changes affect people differentially and through interactions with social factors. Social networks and cohesion are important, in addition to skills, investments and alternative resources; all shape how benefits and costs are distributed. Physical, biological and social systems can interact in complex ways to affect Arctic communities. Impacts of environmental change may affect people in different ways depending on the adaptive capacity and interactions with existing social and economic factors [13].

Socio-economic costs and benefits of environmental change, and their distribution among sectors and within society generally, are shaped by the availability of social, human, physical and natural capital at various scales. While development of economic substitutes and new technologies helps facilitate increased economic adaptive capacity over time, in order to reduce the negative impacts of resource extraction projects and to capture potential social and economic benefits necessary steps involve addressing and implementing systems of effective governance, including clear decision-making, public involvement, and an effective regulatory regime.

In the future, climate change may increase the need for protective institutions due to increased activity levels, while simultaneously making it harder perhaps to build and maintain these institutions [12].

21.3 Sustainability Challenges in the Arctic

Fjellheim and Henriksen [9] discuss the challenges large-scale resource extraction activity presents for indigenous peoples in the Arctic. Social Impact Assessments (SIA), they argue, are problematic for indigenous peoples. SIA is a tool for decision-making and planning – conducted to balance the interests of different parties, with indigenous peoples often included as stakeholders. Problems however include lack of inclusion, effective participation, and procedures that often fail to acknowledge indigenous peoples' values and perspectives. They argue that negotiations are an alternative or supplementary approach to SIA, and that to overcome the shortcomings of SIAs and to meet international human rights standards the concept of free, prior, and informed consent, direct and binding negotiations with indigenous peoples is the best approach.

> Free, Prior, Informed Consent: recognises indigenous peoples' inherent rights to their lands and resources and respects their legitimate authority to require that third parties enter into an equal and respectful relationship with them, based on the principle of prior and informed consent [9].

Socio-economic challenges related to global change pressures can be expected to play a growing role in decisions on resource allocation, resource use, ownership and control, and with important consequences for Arctic economies and prospects for their future economic sustainability. Strategies for sustainable development and Arctic environmental protection need to consider the economic, social and environmental linkages between the Arctic and other regions of the globe. Answers to questions on the future of the Arctic must be found not merely in the analysis of the more traditional theoretical frameworks of core-periphery relations, and central government versus local communities located in northern regions of Arctic states. Rather, it requires the broader perspectives that account also for the growing role and economic dominance of global and transboundary connections, and the increasing role, presence, and conduct of multinational corporations.

Arctic societies are facing an unprecedented combination of rapid and stressful changes involving environmental processes, cultural developments, economic and political changes, and industrial developments [3]. The adaptive capacity of Arctic communities depends on a broad range of factors, including the available technology, size and distribution of wealth, human resources, information and skills, infrastructure, access to institutions, distribution of income and the social welfare system. Successful adaptation of local communities may be compromised when there is a lack of human, technical and natural resources, which set many local and indigenous communities in the North apart from other communities [22]. There are several strategies communities may attempt in order to develop their local economy and to improve the quality of life and local livelihood. Some of the principle strategies for human development by people in the Arctic include forming partnerships with outside actors in developing natural resources; combining subsistence activities with government employment and welfare; negotiating with governments for policies on regional development to create jobs; and using business and political networks to ensure access to international markets [1].

Options for economic adaptation to global change by local and regional economies may be few, but could include: finding and implementing measures to minimise negative impacts and economic costs; spreading the burden of the costs among different economic sectors to raise the chance of economic viability of individual sectors; substituting with new activities that have fewer costs and are more sustainable, i.e. responding to changed economic incentives by reallocating the available natural, financial, and human resources towards new and more sustainable activities. Other measures may include moving industrial activity to other locations where risk of environmental damage is less, and where the net-local benefits are higher and human, physical, and environmental costs lower; or developing ways of strengthening the local adaptive capacity and resilience of the socio-economic system in general. Adaptive capacity may be strengthened by diversification of the local economy to spread the burden and reduce the risk when possibilities for alternative economic opportunities exist [20].

For many northern communities the economic forward and backward linkages between market sectors are however few and limited. It is frequently the case that only a small fraction of production serves as inputs into other sectors of the local or regional economy. Resource use may be less flexible and adaptable in northern local communities, and constraints often exist with the ability of the resource product-mix to adapt to economic volatility and resource supply shock effects. For many local communities there exist a disparity between structure of demand for goods and services and the use of natural resources locally, with a not infrequent paradox emerging where what is being consumed is being imported and what is being produced is being exported. This contributes to fuelling dependency on the external environment. The local economy is left vulnerable and prone to frequent high levels of economic instability [16].

In general, much of the resource extraction in the North is geared to markets outside the North. A central feature of the classic staple theory [5, 14, 24, 27] is the spread effects of the staple product and the process of economic diversification around an export base geared for an external market (e.g. fish) and the process of economic development that follows [27]. Benefits to primary-export-led growth – such as fish, timber, or minerals as seen in the North – may include improved utilisation of existing factors, expanded factor endowments, and economic linkage effects. The resulting economic linkage effects include backward, forward, and final demand linkages. Still, empirical evidence in the literature has suggested that primary natural resource export trade may not be the most effective strategy in leading the way to economic development as theory may otherwise suggests. Weaknesses may result when markets for primary products grow slowly, when earnings are unstable due to price fluctuations, and when expected diversification around the export industry – including linkage creation – may be nonexistent or limited as often seen in smaller, northern economies. In other words, local and regional economies may not benefit as much as they potentially could from northern resource development, and net-benefits could be negative when regional economic multiplier effects are weak or nonexistent.

Small size of internal markets, a narrow resource base, and dependency on a few key commercial resources is a main source of instability in many parts of the North. Much of the economic volatility can be attributed to lack of economic diversification characteristics of many northern communities, a heavy reliance on a small range of natural resources, the associated narrow resource trade that constitutes a primary source of regional income, and the importance of the trade links to foreign markets. The high concentration in resource exports and its high share in contributions to the region's gross income accounts for much of the volatility of the formal market economy, where economic disturbances and resource supply shocks can have large and lasting economic impacts. It is often the sporadic elements of economic fluctuations that are the most problematic. Volatility originating from events that are more predictable or certain is not necessarily the main source of negative adverse consequences, since regularly reversing fluctuations make it easier to predict the level of export trade and income generation each year and to judge the correct timing for the implementation of economic stabilisation policies. The smallness of northern economies combined with their narrow range of commercial resources and a relatively high dependence on global or external markets, means that economic instability becomes more common place. Both kinds of instability are damaging for the northern economy. In the Arctic region the scope for corrective action in response to larger economic out-swings may be more limited due to significant resource constraints though, lack of adaptive capacity in many local communities, and for some places also limits to local and regional economic and political control and decision-making.

In considering the consequences of global change for the future of the North and the development of the region a distinction may be drawn between economic development, industrial development, economic growth, and human development. Detailing these distinctions help shed more light on questions related to northern development, the type of development taking place, and the distribution of net benefits. The traditional view of economic development was that of a sustained increase in gross domestic product, and a declining share of agriculture along with an increasing share of manufacturing and service industries. The more contemporary view redefines development in terms of reductions in poverty, inequitable income distribution and unemployment. In broadening this narrow definition development can be viewed as a process of expanding the real freedoms that people enjoy. Amartya Sen argued that development requires the removal of major sources of 'un-freedom', including poor economic opportunities, poverty, social deprivation, inadequate housing and lack of access to education. This broadened view of economic development is not only appropriate but clearly also necessary. In studying the Northern economy, it allows us to go beyond a mere consideration of the contribution of resource extraction to also consider other critical aspects of economic well-being, and the many important factors that contribute to living conditions and quality of life in the local economy [26]. Thus, while traditionally economic development was equated with economic growth, the contemporary view of development is much broader.

There is a clear distinction between economic growth and economic development; economic growth simply refers to a rise in national or *per capita* income or product. Economic growth is a prerequisite for achieving economic development but it is not a sufficient condition. Key objectives of economic development centre on raising the standard of living and quality of life with higher incomes, more jobs, better education, greater attention to cultural and human values, and the expansion of the range of economic and social choices available. Also, important to the process of economic development is the participation of stakeholders. Participation in the process of economic development implies participation in the enjoyment of the benefits of development as well as the production of those benefits. On the question of whether growth creates development, many would argue that poor regions have sometimes experienced economic growth with little or no economic development. This would be the case for many northern local economies that may have served as important resource reservoirs, with resources destined for foreign markets and often to support economic development outside the north. Economic growth may take place but with limited benefits for the local population. Alternatively, resource projects may give rise to creation of important economic linkage effects locally, help raise taxes and finance social programmes, education and health [8, 22].

Similarly, one could argue that industrial development implies something narrower than economic development; it does not necessarily fulfil the criterion of improved distribution of income and increased employment. Rather it is focused on the "industrial" – the creation of resource development, megaprojects and resource extraction, mining and drilling, possibly with limited consideration of the local socio-economic impacts. In this context the question arises of whether sustainability and improvements in quality of life in the North is derived best from gearing northern resources towards industrial development, or alternatively, from investing in the small scale economic development of local communities. This would involve local participation and decision-making, with benefits accruing more directly to local stakeholders, and with economic leakages to outside markets and economic interests being minimised. This raises questions of whether economic sustainability can be achieved by focusing on non-renewable resource development, and what challenges should be addressed to reverse regional financial leakages; to help strengthen economic sustainability and local benefits and maximize societal benefits from ongoing northern transformations.

The net effect of regional investments or resource extraction is often limited because income, profits and rents leak out of regions when ownership and control over resource use is located elsewhere [7]. Where governance and national-local linkages are weak, communities may see little of the revenues from resource extraction. The solution lies in finding better ways to capture and manage resource wealth and to ensure its investment for the lasting societal benefits in support of regional and local economic development.

Sustainable development – and the creation of a future stream of economic benefits – can be achieved also in economies based on non-renewable resources, when workable solutions are found to effectively convert those resources into other assets that have lasting benefits (e.g. oil or investment funds) and investment in education and training to also facilitate economic diversification. One of the many challenges is to achieve sustainable development by integrating economic activity with environmental integrity, social concerns, and an effective governance system. Reducing environmental costs associated with global change requires responsible stewardship of non-renewable resources, including minimizing waste and environmental damage, and the exercise of prudence where impacts are unknown or uncertain.

Global change, economic and political transformations, and changing cultural landscapes all require adaptations. Arctic communities have indicated that their viability is much enhanced by, having control over their own fate, sustaining contact with nature, and retaining their cultural identity [4]. In this regard, indigenous peoples continue to preserve important elements of human development in the North. Socio-economic transformations and rapid change taking place in the Arctic has increased the emphasis placed on devising indicators for monitoring and measuring change in human development and quality of life. Arctic specific social indicators have been developed that reflect these unique aspects – what residents of the North view as prominent features of human development – to help facilitate long term monitoring of human development in the Arctic [4].

Recent work in the arctic Social Indicators (ASI) working group on constructing a small suite of indicators for tracking human development in the North include the following social indicators which as a collective may do a good job of capturing changes in human development: infant mortality, net-migration, consumption and harvest of local foods, per capita household income, the ratio of students successfully completing post-secondary education, language retention, and a composite index of fate control – people's ability to guide their own destiny [4]. The indicator on fate control is specific to the Northern context, and is interesting because it tells us something about change in empowerment of peoples in the North, and also, it tells us something about the economic sustainability of local communities. This social indicator of human development is composed of indictors on the percentage of indigenous members in governing bodies relative to the percentage of indigenous people in the total population; the percentage of surface lands legally controlled by the inhabitants through public governments, Native corporations and communes; the percentage of public expenses within the region raised locally; and the percentage of individuals who speak a mother tongue [6]. Similarly, the construction of indicators of material well-being in the North that takes into consideration both the formal economy, the subsistence sector, and the transfer sector – can provide us with a more complete overview of the material well-being in the north as it incorporates all three contributions to household income. This ASI indicator – formulated to overcome the weaknesses of using merely the gross domestic product as an indicator of material well-being in the North – addresses one of the big challenges in Northern resource development; that a significant share of profits and rents leave the North and do not remain in the local area or benefits the local residents [4, 19].

21.4 Conclusion

While conflicts of interests over resource use remain high in the North, and while local economic benefits of resource development may remain few, the balance of power related to key issues central to northern development has been changing: the northern resource industry must increasingly address and comply with rules and regulations concerning their conduct and operations, environmental and social impacts assessments, and participate in resolving conflicts of interest over resources and land use. Also, the emergence of the mixed local economy and its increasing role amidst the growing interdependencies between the formal and informal economies affects the balance of power between various northern stakeholders. The growing number of environmental impacts assessments and the increased legal requirements to include and address environmental considerations in resource development projects provides fuel to the issues surrounding the changing balance of power in the North and their resolution.

The growing strategic role and economic and geo-political interests in the Arctic are putting pressures on all stakeholders to find solutions to pressing questions of resource allocation and use, ownership and control, and to addressing observed and potential impacts on socio-economic development and the future of human development and quality of life in the North.

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Chapter 22
Legal Aspects of Navigation Through the Northern Sea Route

Ivan V. Bunik and Vladimir V. Mikhaylichenko

Abstract The Northern Sea Route (NSR) across the Arctic Ocean has been a significant feature of Russia for much of the past century and will play an increasingly important role in the future of the Russian Federation across the twenty-first century. This paper highlights historical features of traffic associated with the NSR, including legal and regulatory strategies of the Russian Federation for international use of the NSR.

22.1 Historic Operations Across the Northern Sea Route

The Northern Sea Route (NSR) is seen as one of the key international transport corridors across the Arctic Ocean between the Pacific and Atlantic Oceans, as discussed prominently in the *Arctic Marine Shipping Assessment* [1] and numerous other reports [4, 7, 8, 10, 25]. Historic features of NSR voyages include:

- In summer 1967, the motor vessel "*Novovoronezh*" owned by Murmansk Shipping Company with a deadweight tonnage (DWT) of around 5,000 tons (ice class ARC-4) performed *a* remarkable double voyage through the NSR during a single navigation period along the route Hamburg-Japan-Murmansk route that took 57 days, including cargo operations in Japan.

I.V. Bunik Ph.D. (✉)
Section of the Law Research Center, Council for Research of Productive Resources (SOPS), Russian Academy of Sciences, 7, Vavilova street, Moscow 117997, Russian Federation
e-mail: i.bunik@tbplaw.com

V.V. Mikhaylichenko
Noncommercial Partnership of the Coordination of Northern Sea Route Usages, 7, Vavilova street, Moscow 117997, Russian Federation
e-mail: mihailichenkovv@mail.ru

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- In summer 1989, the motor vessel "*Tiksi*" owned by Murmansk Shipping Company ("Norilsk" type, 20,000 DWT with Russian highest ice class, ARC-7) repeated such a double transit voyage through the NSR along the route Western Europe – Japan – China – Europe that took 47 days.
- In July 1990, the motor vessel "*Kola*" owned by Murmansk Shipping Company ("Norilsk" type, 20,000 DWT with Russian highest ice class, ARC-7) transited from Hamburg to Tokyo in 19 days, with a NSR crossing that only took 8 days. This voyage still is a record.
- In summer 1990, the biggest vessel ever to transit the NSR was the nuclear LASH carrier and container ship, "*Sevmorput*" with 33,980 DWT.
- In March 1993, during an experimental voyage under the most difficult ice conditions, the *Murmansk-Pevek* (a nuclear icebreaker of "Arktika" type) managed to lead a vessel of "Norilsk" type through the NSR in 28 days.
- In September 2010, the tanker "*SCF Baltica*" (owned by OAO NOVATEK) transited from Murmansk to Ningbo (China) in 23 days, crossing the NSR in 10 days.
- In August 2011 the "*Vladimir Tikhonov*" became the largest supertanker (162,300 tons deadweight) to transit the NSR and in a record 7.4 days. The following month, the tanker *'Palva'* (74,940 tons deadweight) eclipsed the NSR transit record in 6.5 days with an average speed about 14 knots. Also in September 2011, the *'M/V Sanko Odyssey'* became the first Japanese tanker and largest bulk carrier (74,800 tons deadweight) to cross the NSR.

Moreover, in a year of firsts, more than 834,900 tons of cargo (82 % hydrocarbons) was transported in 2011, which is an absolute record for the NSR.

"*Sevmorput*" is still in operation and is one of four nuclear-powered cargo ships ever built. "*Sevmorput*" has done year-round navigation on the Murmansk-Dudinka line with containers on board. However, operational experience has shown that from November through June, "*Sevmorput*" needs icebreaker escort because the vessel can get stuck even in 30-cm sea ice with large pressure ridges.

Russia has a database of navigation along Arctic routes for more than 70 years, including NSR transit navigation (Tables 22.1 and 22.2). Through 2009, traffic along the NSR was at its peak in 1987 with 6,579,000 tons. Moreover, carrying of goods along NSR has not been interrupted, even during World War II, when traffic increased by 30 % despite all difficulties.

22.2 Legal Developments for the Northern Sea Route

There have significant legal developments for the NSR [3] since the Murmansk speech by Soviet President Mikhail Gorbachev (1987), in which he noted:

> The shortest sea route from Europe to the Far East and the Pacific Ocean passes through the Arctic. I think that depending on progress in the normalization of international relations we could open the North Sea Route to foreign ships, with ourselves providing the services of ice-breakers.

Table 22.1 Annual vessel traffic (1,000 tons) on the Northern Sea Route (NSR) from 1933 to 2009

Year	Traffic	Year	Traffic
1933	130	**1972**	3,279
1934	134	**1973**	3,599
1935	176	**1974**	3,969
1936	201	**1975**	4,075
1937	187	**1976**	4,349
1938	194	**1977**	4,553
1939	237	**1978**	4,789
1940	350	**1979**	4,792
1941 WW II	165	**1980**	4,952
1942 WW II	177	**1981**	5,005
1943 WW II	289	**1982**	5,110
1944 WW II	376	**1983**	5,445
1945 WW II	444	**1984**	5,835
1946	412	**1985**	6,181
1947	316	**1986**	6,455
1948	318	**1987**	6,579 (max)
1949	362	**1988**	6,295
1950	380	**1989**	5,823
1951	434	**1990**	5,510
1952	489	**1991**	4,804
1953	506	**1992**	3,909
1954	612	**1993**	3,016
1955	677	**1994**	2,300
1956	723	**1995**	2,362
1957	787	**1996**	1,642
1958	821	**1997**	1,945
1959	888	**1998**	1,458 (min)
1960	963	**1999**	1,580
1961	1,013	**2000**	1,587
1962	1,164	**2001**	1,800
1963	1,264	**2002**	1,600
1964	1,399	**2003**	1,700
1965	1,455	**2004**	1,718
1966	1,778	**2005**	2,023
1967	1,934	**2006**	1,956
1968	2,179	**2007**	2,150
1969	2,621	**2008**	2,219
1970	2,980	**2009**	1,801
1971	3,032		

Data from: Council for Research of Productive Resources (SOPS), Russian Academy of Sciences and the "Soyizmorniiproekt"

Table 22.2 Main characteristics of ship cargoes along the Northern Sea Route from 1985 to 2006

Year	Cargo characteristics: Total cargo volume (1,000 tons)	Liquid cargo (1,000 tons)	Quantity of cargo (pieces)	Number of transport voyages (trips)
1985	6,181.3	1,013.5	296	1,115
1990	5,510.5	854.0	252	886
1995	2,361.3	226.4	134	309
2000	1,587.0	287.1	52	169
2001	1,800.0	353.3	60	194
2002	1,599.6	288.6	47	170
2003	1,695.0	394.5	47	160
2004	1,717.5	360.5	47	160
2005	2,022.6	562.0	48	168
2006	1,956.0	584.1	47	180

Data from: Council for Research of Productive Resources (SOPS), Russian Academy of Sciences and the "Soyizmorniiproekt"

Four years later, just before end of the Soviet Union [24], *Regulations For Navigation on the Seaways of the Northern Sea Route* were officially published.

The NSR has been defined by the Russian Federation [14] in its federal law: "*About Internal Sea Waters, Territorial Waters and Adjacent Area of the Russian Federation.*" Article 14 of this Russian law (as amended on 23 July 2008 by Article 61 of federal law No. 160) states:

> Navigation on the seaways of the Northern Sea Route, a historically developed national uniform transport communication of the Russian Federation in the Arctic, including through the Vil'kitski, Shokal'sky, Dmitry, Laptev and Sannikov straits, is carried out according to the present federal law, other federal laws, international treaties of the Russian Federation and regulations for navigation on the seaways of the Northern Sea Route, approved by the federal enforcement organ authorized by the Government of the Russian Federation and published in the Notices to Mariners.

Russian Federation [15] *Regulations Regarding the Northern Sea Route and the Arctic Region,* summarized information concerning the legal regime of the Northern Sea Route. Revision of existing regulations and development of new regulations governing maritime transport, ordered that previous regulations and orders of the Soviet Ministry of Marine on the Northern Sea Route and Arctic region shall be considered to:

- Have lost force according to Appendix 1 of the *Regulations;*
- Be in full force and effect according to Appendix 2 of the *Regulations;*
- Remain in force, but subject to revision, according to Appendix 3 of the *Regulations;* and
- Involve service of the Navy, including revision of acts listed in Appendix 3 of the *Regulations* for naval research and development in 1999.

Additionally, regulations from the Ministry of Transport of the Russian Federation [22] involves *Rules of Pilotage in Ice-Covered Waters.* Current information about rules and regulations governing the Northern Sea Route can be found on the official website of Ministry of Transport of the Russian Federation [23], including the following documents.

- *Commemorative Booklet to the Owner or Master of a Vessel;*
- *Regulation for Navigation on the Seaways of the Northern Sea Route;*
- *Regulations for Icebreakers and Pilot Guiding of Vessels through the Northern Sea Route;*
- *Requirements for the Design, Equipment and Supply of Vessels, Navigating the Northern Sea Route;*
- *Federal Rates Service (Order No. 322-T* from 26 July 2005).

One of the main issues of interest to foreign vessel owners is the amount of fees that Russian and foreign users of the NSR are obliged to pay for transiting through the NSR. On one hand, using the NSR provides a shorter distance route between the Atlantic and Pacific Oceans, as compared to transit through the Suez or Panama Canals. On the other hand, high fees collected by Russian organizations raises the question about whether using the NSR is disadvantageous from an economical point of view. Moreover, one may ask, why do I have to pay if I do not need services of a Russian icebreaker? For example, I am a German vessel owner and I have my own icebreaker capable to transit the NSR without any assistance of Russian icebreakers.

The Russian Open Joint Stock Company (OJSC), "*Murmansk Shipping Company*" (MSC), renders much of the services to ships on routes of the NSR. It is believed that since the NSR is a "*Russian national seaway*", then Russian and foreign shipping companies have to pay the MSC for using the NSR.

The main problem arises when we address legal grounds of such payments, imposed to users of the NSR. In this case aspects of public law and private law have to be analyzed thoroughly. Public law aspects mainly refers to interests of protection of the environment, safety of navigation and other features. Private law aspects refer to fees that the MSC (recently also the State corporation "Rosatom" for nuclear icebreakers) as NSR operators want to obtain from foreign vessel owners. It would be reasonable to elaborate comprehensive modern approach that separates public and private law aspects for imposing charges to foreign users of the NSR [5, 26].

Let us give an example based on the Supreme Court ruling of the Russian Federation [13], which admitted the position of the MSC. In accordance with this position, the legal ground for the collection of fees did not reside on the fact that the vessel owner uses MSC's services, including the pilotage in ice-covered waters. It referred to the fact that the vessel *actually* is on the NSR. Then, the fee shall financially cover all measures intended to operate the NSR as a whole system properly. The logic implied that on the one hand there are private relationships governed by private law, and you do not pay for services since you do not get services. But on the other hand public interests require collection of fees anyway, even if vessel owners use the NSR without the official support by the MSC. This means that one is obliged to pay regardless of whether the vessel owner needs or actually gets a service.

One has to pay because he simply enters the NSR, and he pays for the fact that the NSR exists and is properly maintained.

Due to the lack of clear public law concerning the NSR, recent judicial practice views private law as the priority. This legal position is not in line with the legal grounds that Russian organizations rely on for their right to collect fees for vessels using the NSR. Since there is no comprehensive legislation designating a competent government authority to protect public interests, arbitration courts primarily refer to Civil Codes of the Russian Federation [11, 12, 16, 17] and apply the following logic: 'no services – no fees.'

For example, the Supreme Arbitration court of the Russian Federation [18] ruled on December 12, 2007 that the MSC is not entitled to collect fees from OJSC "*GMK Norilsy Nikel*" when the claimant failed to prove that it actually rendered services of pilotage in ice-covered waters to *Nornikel.* The Court referred to articles 1, 307 and 779 of the Civil Code of the Russian Federation [11, 12, 16, 17] and decided that relationships between the parties arose from NSR usage shall be governed by rules applicable to contracts for rendering services.

The same position was confirmed by another court decision [19]. The Court judged that since the vessel operated by the Respondent party (*Nornikel*) is technically suitable to operate ice-covered waters without pilotage services in ice-covered waters, then the Claimant is not entitled to collect fees. The Claimant position was as always a referral to simple fact of using NSR ('you use the NSR – you pay'). The Court did not make any referrals to public law interests (such as environmental protection) since MSC is not a governmental authority to ensure public interests.

22.3 Future Development of the North Sea Route

Despite the fact that there is little experience of leading high capacity vessels under Arctic conditions [6], high-capacity container ships and tankers for use in the Arctic (displacement more than 100,000 tons) are already being designed and built. However, due to their high construction cost, it seems reasonable to conduct experimental voyages with scientists and experts from different countries on board. In fact, the history of development of new technologies for Arctic navigation shows that new stages have been preceded by experiments:

- In August 1969 – accompanied by the Canadian Coast Guard icebreakers "*John A. Macdonald*" and "*Louis S. St-Laurent*" along with the United States Coast Guard icebreakers "*Northwind*" and "*Staten Island*" – the "*SS Manhattan*" (a 305-m oil tanker with 106,000 DWT) became the first commercial ship to cross the Northwest Passage;
- Year-round navigation along the Enisey River to Dudinka port proceeded from 1970 to 1978;
- In winter 1976, there was a cargo shipment to Yamal with unloading on fast ice;
- On 17 August 1977, the Soviet nuclear icebreaker "*NS Arktika*" became the first surface vessel to reach the North Pole;

- Transit voyages along Northern Sea Route in April-May under the most difficult ice conditions (1993–1994);
- In winter 1998, there was export of gas condensate from Ob' Bay as part of the international project, ARCDEV, that involved a "*demonstration voyage and various research activities and investigations related to commercial shipping transport of hydrocarbons from Russian arctic to European market area*" [2].

Prior to mass construction of high capacity vessels to transit the NSR, the "*Noncommercial Partnership for the Coordination of Northern Sea Route Usages*" has suggested an *'Arctic Shuttle Project'* to address variants of practical implementation of the NSR corridor:

- Year-round efficient and safe navigation of transport vessels with high ice class in Arctic ice escorted by powerful icebreakers (including nuclear icebreakers) along the most suitable routes (both coastal and high latitudinal), depending on real-time (current) ice conditions;
- High ice-class vessels (being the most expensive) should be used only on the ice-covered part of the route. The running expenses and capital costs of high ice-class vessels are higher as compared to ordinary vessels;
- Ordinary vessels (without ice-class, faster, cheaper, and more economically efficient) should be used on open-water parts of the route. Loading of these ordinary vessels may be done in the ports of Germany, the Netherlands and other European countries in the West and in the United States, Japan, China and other nations in the East;
- Reloading of cargo can be done in the ports, nearest to the ice zone such as Murmansk, Arkhangelsk and Kirkenes in the West and Provideniya, Adak, Dutch Harbour, Anchorage, Petropavlovsk and Kamchatsky in the East.

Emphasis of the Russian government to develop the NSR was reinforced by comments from Prime Minister Vladimir Putin at the Second International Arctic forum convened by the Russian Geographic Society ("*The Arctic – Territory of Dialogue*") in Arkhangelsk on 23 September 2011, when he noted:

> Developing modern infrastructure along the Northern Sea Route is a major objective. We are launching a comprehensive transport project designed to ensure the dynamic development and exploration of our northern territories, resolve vital economic and social challenges and create new production lines and jobs. We are planning to expand existing ports and build new ones, for instance the Port of Varandei by the Yugorsky Shar Strait and the Sabetta Port on the Yamal Peninsula. The NSR and its major harbours will be integrated with other modes of transport. We are also planning to upgrade river, car and railway routes and communications, northern airfields, airports and polar aviation. We are going to considerably expand our ice-breaker fleet. Today we have 10 ice-breakers. We intend to build another three all-purpose nuclear-powered icebreakers and six diesel-electric ones before 2020. We have allotted 38 billion roubles for this purpose until 2014 [9].

Overall, development of the NSR is a significant feature of the Arctic policy of the Russian Federation [20], which covers the period until 2020. Similarly, the national maritime strategy of the Russian Federation [17] is relevant to the Northern Sea Route for the period until 2020. Moreover, the transport strategy of the Russian Federation [21] is specifically relevant to Arctic shipping across the

NSR through 2030 with relevance "*in the field of research, development and use of the oceans in the interest of security, sustainable economic and social development of States.*"

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Chapter 23
Ensuring Safe, Secure and Reliable Shipping in the Arctic Ocean*

Heike Deggim

Abstract The paper presents an overview of progress from the International Maritime Organization (IMO) regarding various requirements for ships operating in polar waters, with special emphasis on the requirements for the Arctic, including provisions concerning matters such as stability, life-saving appliances, navigation, guidelines for ships operating in polar waters, special area status, carriage requirements for heavy grade fuel oil, certification of ice navigators, and fishing vessels. Relevant international conventions include the following: *International Convention for the Safety of Life at Sea* (SOLAS 1974) http://treaties.un.org/doc/Publication/UNTS/Volume%201184/v1184.pdf.; 1973 *International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 relating thereto* (MARPOL 73/78) http://treaties.un.org/untc//Pages//doc/Publication/UNTS/Volume%201340/volume-1340-I-22484-English.pdf.); *International Convention on Standards of Training, Certification and Watchkeeping for Seafarers* (STCW 1978) http://www.admiraltylawguide.com/conven/stcw1978.html.); and *Torremolinos International Convention for the Safety of Fishing Vessel, 1977, as modified by the Torremolinos Protocol of 1993 relating thereto* http://www.ecolex.org/server2.php/libcat/docs/TRE/Multilateral/En/TRE001173.doc.). IMO's ongoing work on the development of a mandatory International Code of Safety for Ships Operating in Polar Waters is described in some detail. The paper also briefly touches on relevant provisions of the *United Nations Convention on the Law of the Sea* (UNCLOS 1982) as well as on other international requirements and activities concerning the subject in which IMO is directly or indirectly involved.

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* Views expressed in this paper are those of the author and should not be construed as necessarily reflecting the views of International Maritime Organization or its Secretariat.

H. Deggim (✉)
Marine Technology Section, Maritime Safety Division, International Maritime Organization (IMO), 4 Albert Embankment, London SE1 7SR, UK
e-mail: hdeggim@imo.org

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23.1 Introduction

The International Maritime Organization (IMO) is the United Nations specialized agency with responsibility for the safety and security of shipping and the prevention of marine pollution by ships. It was established by a United Nations convention [4] and, following its entry into force in 1958, met for the first time in 1959. The purposes of the IMO, as summarized by Article 1(a) of the 1948 Convention, are:

> to provide machinery for cooperation among Governments in the field of governmental regulation and practices relating to technical matters of all kinds affecting shipping engaged in international trade; to encourage and facilitate the general adoption of the highest practicable standards in matters concerning maritime safety, efficiency of navigation and prevention and control of marine pollution from ships.

It is also empowered to deal with administrative and legal matters related to these purposes. IMO is the only United Nations specialized agency to have its Headquarters in the United Kingdom. As of July 2012, the IMO involves 170 Member States and three Associate Members. The overall objectives are summed up in the IMO slogan: *"Safe, secure and efficient shipping on clean oceans"*.

Ships operating in the polar environments are exposed to a number of unique risks. Poor weather conditions and the relative lack of good charts, communication systems and other navigational aids pose challenges for mariners. The remoteness of the areas makes rescue or clean-up operations difficult and costly. Cold temperatures may reduce the effectiveness of numerous components of the ship, ranging from deck machinery and emergency equipment to sea suctions. When ice is present, it can impose additional loads on the hull, propulsion system and appendages.

Whilst Arctic and Antarctic waters have a number of similarities, there are also significant differences. The Arctic is an ocean surrounded by continents while the Antarctic is a continent surrounded by an ocean. The Antarctic sea ice retreats significantly during the summer season or is dispersed by permanent gyres in the two major seas of the Antarctic: the Weddell and the Ross. Thus there is relatively little multi-year ice in the Antarctic. Conversely, Arctic sea ice survives many summer seasons and there is a significant amount of multi-year ice. Whilst the marine environments of both polar seas are similarly vulnerable, response to such challenge should duly take into account specific features of the legal and political regimes applicable to their respective marine spaces.

Over the last 20 years or so, IMO has developed a raft of requirements, guidelines and recommendations regarding navigation in polar waters, relating to maritime safety (construction, search and rescue, navigation, life-saving, etc.) and marine pollution prevention (designation of special areas, carriage of heavy fuel oil, etc.) as well as certification and qualification of seafarers on ships operating in polar areas.

The following gives an overview of the currently available provisions, with a brief outline of the requirements of the instruments in question, and also reports on current activities in IMO with regard to polar areas, specifically the ongoing work on a mandatory International *Code of Safety for Ships Operating in Polar Waters*.

In particular, mandatory requirements as contained in the following IMO Conventions and in related codes, as well as related recommendatory guidelines, are introduced and briefly explained:

- International Convention on the Safety of Life at Sea [17];
- *International Convention for the Prevention of Pollution from Ships*, 1973, as modified by the Protocol of 1978 relating thereto [16];
- *International Convention on Standards of Training, Certification and Watchkeeping for Seafarers* [18]; and
- *Torremolinos Protocol of 1993 to the* 1977 *Torremolinos International Convention for the Safety of Fishing Vessels* [19].

For completeness, provisions for ice-covered areas as contained in the *United Nations Convention on the Law of the Sea* [20] also are included.

23.2 UNCLOS Requirements Concerning Ice-Covered Areas

UNCLOS in its 320 articles and nine annexes, sets out the legal framework governing the rights and responsibilities of nations in their use of ocean space, such as delimitation, environment, management of marine natural resources and settlement of disputes. UNCLOS was opened for signature on 10 December 1982 and entered into force on 16 November 1994. To date, 162 States have signed UNCLOS, whereby 22 of those signatories have not yet ratified the Convention. Seven of the eight Arctic states have ratified UNCLOS with the exception of the United States. Of special relevance to the polar regions is UNCLOS Article 234 (Ice-covered areas), which states that:

> coastal States have the right to adopt and enforce non-discriminatory laws and regulations for the prevention, reduction and control of marine pollution from vessels in ice-covered areas within the limits of the exclusive economic zone, where particularly severe climatic conditions and the presence of ice covering such areas for most of the year create obstructions or exceptional hazards to navigation, and pollution of the marine environment could cause major harm to or irreversible disturbance of the ecological balance. Such laws and regulations shall have due regard to navigation and the protection and preservation of the marine environment based on the best available scientific evidence.

23.3 SOLAS Requirements Concerning Polar Areas and Related Guidelines

Requirements in the SOLAS Convention that directly relate to polar areas are contained in Chapter V (Safety of Navigation). Regulation 5 (Meteorological Services and Warnings) requests SOLAS Contracting Governments to encourage the collection of meteorological data by ships at sea and to arrange for their examination, dissemination and exchange in the manner most suitable for the purpose of aiding navigation, including, *inter alia*, to issue at least twice daily weather information suitable for shipping containing data, analyses, warnings and forecasts of weather, waves and ice. Regulation 6 (Ice Patrol Service), provides requirements concerning the Ice Patrol Service in the North Atlantic, in line with the Rules for the management, operation and financing of the North Atlantic Ice Patrol which became operative beginning with the ice season of 2002.

Further SOLAS requirements concern Regulation 31, which obliges the master of every ship that meets dangerous ice, a dangerous derelict, or any other direct danger to navigation to communicate the information to ships in the vicinity, and also to the competent authorities. In addition, Regulation 32 specifies the information required in danger messages, such as kind, position, time and date of dangers observed; barometric pressure and tendency; wind force and direction; sea state; swell, including direction from which it comes, period or length; and true course and speed of the ship.

In December 2008, the Intact Stability Code was adopted by IMO's Maritime Safety Committee (MSC) and made mandatory under the SOLAS Convention and the 1988 Load Lines Protocol. The Code contains mandatory (Part A) and recommendatory (Part B) provisions concerning the intact stability of all types of ships covered by IMO instruments and provides stability criteria and other measures to ensure safe operation and to minimize the risk to ships, crew and the environment.

Part B of the Intact Stability Code contains in chapter 6 (Icing considerations) provisions for ships operating in areas where ice accretion is likely to occur which would adversely affect a ship's stability and provides that icing allowances should be included in the analysis of conditions of loading. More detailed guidance is included for cargo ships carrying timber deck cargoes, fishing vessels and offshore supply vessels of 24–100 m length.

23.4 Guidelines for Ships Operating in Polar Waters

Navigation in polar waters was first addressed by the *Guidelines for Ships Operating in Arctic Ice-Covered Waters* [10], which provided requirements additional to those of the SOLAS and MARPOL conventions for navigation in Arctic waters, taking into account the specific climatic conditions in that area in order to meet appropriate standards of maritime safety and pollution prevention. Following a request by the XXVIIth Antarctic Treaty Consultative Meeting [1] to amend the Guidelines so that they would also be applicable to ships operating in the Antarctic Treaty Area as well, the 26th IMO Assembly adopted *Guidelines for Ships Operating in Polar Waters* [15].

The Guidelines aim at mitigating the additional risk imposed on shipping due to the harsh environmental and climatic conditions existing in polar waters and address the additional demands on ship systems, including navigation, communications, life-saving appliances, main and auxiliary machinery, environmental protection and damage control, etc. In addition, they recognize that safe operation in such conditions requires specific attention to human factors including training and operational procedures and provide that all ships operating in polar ice-covered waters should carry at least one ice navigator (i.e., an individual who, in addition to being qualified under the STCW Convention, is specially trained and otherwise qualified to direct the movement of a ship in ice-covered waters).

23.5 Development of a Mandatory Code for Ships Operating in Polar Waters

Immediately after approval of the guidelines that apply to the Arctic and Antarctic [15], which are of a recommendatory character, the MSC agreed with proposals to commence work on the development of a mandatory Code for ships operating in polar waters, with a target completion year of 2012. The new Code would cover the full range of design, construction, equipment, operational, training, search and rescue and environmental protection issues relevant to ships operating in polar waters in order to address the increased interest and traffic in these regions and the unique operational, environmental and search and rescue concerns peculiar to these areas, taking into account that the consequences of any major safety or pollution incident in polar waters are likely to cause widespread harm to these pristine environments and also damage to the reputation of the shipping community.

Work currently is underway in the IMO Sub-Committee on Ship Design and Equipment, which advocated a goal-based approach based on objectives and functional requirements, and concentrates on the identification of the various hazards of ship operations in polar waters, emphasizing the purpose of the Code (i.e., to prevent or mitigate the consequences of hazards not particularly covered by other IMO instruments). However, the work is ongoing and possible methods to carry out the risk analysis and the determination of risk control options need to be further discussed. Various other matters, including, *inter alia,* application to ship types, operational limitations based on geographical boundaries, structure of the Code, grouping of hazards, possible risks posed by shipping to indigenous and other local communities in the Arctic, special training and manning requirements and polar ship certification, all of which need further intensive consideration, will also need to be considered in detail.

23.6 IMO Guidelines Relevant to Polar Operations

23.6.1 Guide to Cold Water Survival

In 1981, IMO developed the first issue of a *Guide to Cold Water Survival*, providing advice to ships operating in cold water areas on how to prevent or minimize hazards of cold exposure, emphasizing individual responsibility to effect survival in cold water and advising on simple self-help techniques. The Guide was further revised in

1992 and 2006 and finally approved by the MSC [12]. It explains in particular bodily reactions to cold air and water exposure, informs about body heat loss, insulation and hypothermia, gives recommendations on what to do in the case of ship abandonment in cold waters, advises on the treatment of immersion survivors, and contains useful checklists for cold water survival and for rescuers.

23.6.2 Enhanced Contingency Planning Guidance for Passenger Ships Operating in Areas Remote from Search-and-Rescue (SAR) Facilities

In 2006, IMO's Sub-committee on Radiocommunications and Search and Rescue (COMSAR) prepared *Enhanced Contingency Planning Guidance for Passenger Ships Operating in Areas Remote from SAR Facilities* [13], which are required in accordance with the relevant provisions of the SOLAS Convention, the *International Convention on Maritime Search and Rescue* [3] and the *International Safety Management Code* [7].

For practical purposes, COMSAR agreed that an area in which an emergency occurs may be considered one which is "*remote from SAR facilities*" [13] if either the SAR facilities total recovery capacity or the capacity they are able to achieve in the prevailing conditions and within the 5-day parameter (i.e. the maximum timeframe for which persons should be expected to stay in survival craft, taking into account the humanitarian needs of those aboard such craft and the hazards to life and health persons may face on such craft, as agreed by the MSC) is less than the number of people who need to be recovered.

The guidance recommends that SAR co-operation planning arrangements should be enhanced for ships operating in areas remote from SAR facilities, including giving reasonable notice of the arrival of its ship in the remote area to the relevant Rescue Co-ordination Centre (RCC) and arranging direct exchange of the ship's SAR co-operation plan with the relevant SAR services; that the relevant SAR services may request a copy of the relevant part of the Company's emergency plan, in addition to the basic SAR co-operation plan, in order to assist their own contingency planning; and that the Company should keep the RCC informed as to the ship's position and intentions while the ship is operating in the remote area.

It is further recommended that risks of remote area operations should be assessed and planned for and that the following enhancements should be among those considered:

- Voyage 'pairing' (i.e., mutual exchange of information that may be available to the SAR Authority or the vessel operator with reference to other passenger ships operating in the same area, so that, if two or more passenger ships are operating in the same general area at the same time, each can be used as a SAR facility in case of accident to another);
- Carriage of enhanced life-saving appliances;
- Provision of additional life-saving resources; and
- Other sources of assistance that may be available in the remote area.

23.6.3 Guidelines on Voyage Planning for Passenger Ships Operating in Remote Areas

The IMO Assembly adopted *Guidelines on Voyage Planning for Passenger Ships Operating in Remote Areas* [14] to supplement the existing *Guidelines for Voyage Planning* [8] with additional guidance for passenger ships operating in remote areas. It was acknowledged that the growing popularity of ocean travel and the desire for exotic destinations had led to increasing numbers of passenger ships operating in remote areas and that, when developing a plan for voyages to such areas, special consideration needed to be given to the environmental nature of the area of operation, the limited resources and navigational information.

The Guidelines recommend that, for ships operating in Arctic or Antarctic waters, the usual detailed voyage and passage plan should include additional factors, such as knowledge of ice and ice formations; current information on the extent and type of ice and icebergs in the vicinity of the intended route; statistical information on ice from former years; operational limitations in ice-covered waters; availability and use of ice navigators; conditions when it is not safe to enter areas containing ice or icebergs because of darkness, swell, fog and ice pressure; safe distance to icebergs; presence of ice and icebergs and safe speed in such areas; existing ice conditions; and measures to be taken before entering waters where ice may be present, e.g., an abandon ship drill and preparation of special equipment.

23.6.4 International Association of Classification Societies (IACS) Requirements for Polar Class Ships

IMO's *Guidelines for Ships Operating In Polar Waters* [15] recommend that only those ships with a Polar Class designation, assigned based on the IACS [2] Unified Requirements for Polar Class Ships (UR-I), or a comparable alternative standard of ice-strengthening appropriate to the anticipated ice conditions should operate in polar ice-covered waters. The UR-I are uniformly applied by IACS societies to ships contracted for construction on or after 1 March 2008.

The UR-I contain the following Polar Class notations, intended to guide owners, designers and Administrations in selecting an appropriate Polar Class (PC) to match the requirements for a given ship with its intended voyage or service. The ice description follows the sea ice nomenclature of the World Meteorological Organization:

PC 1: Year-round operation in all ice-covered waters.
PC 2: Year-round operation in moderate multi-year ice conditions.
PC 3: Year-round operation in second-year ice which may include multi-year ice inclusions.
PC 4: Year-round operation in thick first-year ice which may include old ice inclusions.

PC 5: Year-round operation in medium first-year ice which may include old ice inclusions.
PC 6: Summer/autumn operation in medium first-year ice which may include old ice inclusions.
PC 7: Summer/autumn operation in thin first-year ice which may include old ice inclusions.

The UR-I consist of three parts:

I1: Polar class description and application;
I2: Structural requirements for polar class ships; and
I3: Machinery requirements for polar class ships.

The Polar Class notation is used throughout to convey the differences between classes with respect to operational capability and strength. It should be noted that ships that are also to receive an *"icebreaker"* notation may have additional requirements and need special consideration. *"Icebreaker"* refers to any ship having an operational profile that includes escort or ice management functions, having powering and dimensions that allow it to undertake aggressive operations in ice-covered waters, and having a class certificate endorsed with this notation.

23.7 MARPOL Requirements Concerning Polar Areas

23.7.1 Special Areas Under MARPOL Annexes I and V

The MARPOL Convention defines in Annexes I (*Prevention of Pollution by Oil*) and V (*Prevention of Pollution by Garbage from Ships*) certain sea areas as *"special areas"* in which, for technical reasons relating to their oceanographical and ecological condition and to their sea traffic, the adoption of special mandatory methods for the prevention of sea pollution is required. Under the MARPOL Convention, these special areas are provided with a higher level of protection than other areas of the sea. Reference is made to *Guidelines for the Designation of Special Areas* under MARPOL 73/78 [9], providing guidance to Contracting Parties to MARPOL in the formulation and submission of applications for the designation of Special Areas.

The Antarctic area was designated a special area under MARPOL Annexes I and V [5] and under MARPOL Annex II [6]. The provisions entered into force on 17 March 1992 for Annexes I and V and on 1 July 1994 for Annex II. However, in the latter case, the revised Annex II [11], now in force, does no longer contemplate special areas, as very stringent discharge requirements are now applicable in all sea areas worldwide. In this regard, it should be noted that the Artic is not considered a special area under the MARPOL Convention.

23.7.2 Control of Discharge of Oil and Reception Facilities (MARPOL Annex I)

MARPOL Annex I contains particular requirements for special areas in Chapter 3 (*Requirements for Machinery Spaces of Ships*), regulation 15 (Control of Discharge of Oil); Chapter 4 (*Requirements for the Cargo Areas of Oil Tankers*), Regulation 34 (Control of Discharge of Oil); and Chapter 6 (*Reception Facilities*), Regulation 38 (*Reception Facilities*).

Regulation I/15.4 prohibits any discharge into the sea of oil or oily mixtures from any ship in the Antarctic area. Regulation I/34.3 prohibits any discharge into the sea of oil or oily mixtures from the cargo area of an oil tanker while in a special area, except for the discharge of clean or segregated ballast. Regulation I/38.4 requires MARPOL Parties which border any special area to ensure that all oil loading terminals and repair ports within the special area have adequate facilities for the reception and treatment of all dirty ballast and tank washing water from oil tankers and for other residues and oily mixtures from ships.

23.7.3 Control of Discharge of Residues of Noxious Liquid Substances (MARPOL Annex II)

MARPOL Annex II, Regulation 13.8 (Discharges in the Antarctic Area), prohibits any discharge into the sea of noxious liquid substances or mixtures containing such substances in the Antarctic area.

23.7.4 Disposal of Garbage (MARPOL Annex V)

MARPOL Annex V contains particular requirements for special areas in Regulation 5 (Disposal of Garbage Within Special Areas), which prohibit, with some exceptions, the disposal into the sea of all plastics and all other garbage and provide requirements for reception facilities, with special rules for the Antarctic area.

23.7.5 Use and Carriage of Heavy Grade Oil

The issue of the use and carriage of heavy grade oil on ships in the Antarctic area and the development of relevant amendments to MARPOL Annex I was first considered by IMO's Marine Environment Protection Committee (MEPC) in 2007, initiated by a request from Norway. The Sub-Committee on Bulk Liquids and Gases (BLG) was instructed to consider the matter further and based its discussions of the matter on a proposal by New Zealand to add a new chapter concerning the carriage in bulk and use as fuel of oils in the Antarctic area to MARPOL Annex I. Consequently, MEPC 60 in March 2010 adopted the new requirements, which entered into force on 1 August 2011, adding a new Chapter 9 (Special Requirements for the Use or Carriage of Oils in the Antarctic Area) to MARPOL Annex I, establishing a ban on the use and carriage of heavy grade oils in the Antarctic area. Again, it should be noted that the new requirements will only apply to the Antarctic and not to the Arctic.

23.8 Oil Spill Response in Ice and Snow Conditions

In the context of spills in ice-covered waters, IMO's Oil Pollution Preparedness, Response and Co-operation (OPRC) and Hazardous and Noxious Substances (HNS) Technical Group operating under the MEPC publishes information on oil spill response in ice and snow conditions. This publication is intended to address all aspects of oil spill response and will make particular note of the substantial body of recent and ongoing research to address the potential problem of spills in cold environments.

23.9 STCW Requirements Concerning Polar Areas

Major revisions to the STCW Convention and the STCW Code were adopted in June 2010 in Manila, at a Conference of Parties to the Convention. The amendments, known as *"the Manila amendments to the STCW Convention and Code"* and which entered into force on 1 January 2012, include new training guidance for personnel serving on board ships operating in polar waters. The Conference also adopted a number of resolutions, including Conference Resolution 11 on Measures to ensure the competency of masters and officers of ships operating in polar waters.

23.9.1 Training Guidance for Personnel Serving on Board Ships Operating in Polar Waters

The newly adopted guidance (STCW Convention), Part B (Recommended Guidance Regarding Provisions of the STCW Convention and its Annex), Chapter V (Guidance Regarding Special Training Requirements for Personnel On Certain Types of Ships), Section B-V/g (Guidance Regarding Training of Masters and Officers for Ships Operating in Polar Waters) stresses the importance for officers in charge of a navigational watch and officers in charge of an engineering watch on board ships operating in polar waters to have sufficient and appropriate experience in operating ships in polar waters. In particular, for masters and officers in charge of a navigational watch, it stipulates that the training should provide:

- Basic knowledge on ice characteristics and ice areas;
- Ship performance in ice and cold climate;
- Voyage and passage planning for a ship in ice;
- Operating and handling a ship in ice;
- Local requirements for entering different regions;
- International regulations and recommendations;
- Equipment limitations;
- Safety precautions and emergency procedures; and
- Environmental considerations.

For officers in charge of an engineering watch, the training should provide basic knowledge on some of the above subjects.

23.9.2 Measures to Ensure the Competency of Masters and Officers of Ships Operating in Polar Waters

Resolution 11 of the Manila Conference (Measures to Ensure the Competency of Masters and Officers of Ships Operating in Polar Waters) recommends that Governments adopt measures conducive to ensuring that masters and officers of ships which operate in polar waters have appropriate training and experience, so that they are able to:

1. Plan voyages to polar waters, taking into account glaciological, hydrographic, oceanographic and meteorological factors;
2. Navigate safely in polar waters, in particular in restricted ice-covered areas under adverse conditions of wind and visibility; and
3. Supervise and ensure compliance with the requirements deriving from intergovernmental agreements and with those relating to safety of life at sea and protection of the marine environment.

23.10 Fishing Vessels Operating in Areas with Ice Accretion

The 1977 Torremolinos Convention contains safety requirements for the construction and equipment of new decked seagoing fishing vessels of 24 m in length and over, including those vessels also processing their catch. The conditions for entry into force of the Convention were never met and in 1993 the Torremolinos Protocol was adopted which updates, amends and absorbs the parent Convention, taking into account technological evolution in the intervening years and the need to take a pragmatic approach to encourage ratification of the instrument. The Torremolinos Protocol has likewise not yet entered into force.

Chapter III (Stability and Associated Seaworthiness), regulation 8 (Ice accretion), contains requirements for icing allowances to be made in stability calculations and provides that fishing vessels operating in areas where ice accretion is known to occur should be designed to minimize the accretion of ice and should be equipped with means for removing ice. Recommendation 2 (Guidance Related to Ice Accretion) of the 1993 Torremolinos Protocol further sets out the geographical positions of the icing areas to which the above Regulation III/8 should apply, including a chart. Recommendation 6 (Guidance for Precautions Against Freezing of Fire Mains) offers solutions for the problem of freezing of fire mains, including recirculation of water, use of dry systems of fire mains, use of leak-off systems and use of heating systems.

The 2005 *Code of Safety for Fishermen and Fishing Vessels* was developed by IMO in cooperation with the Food and Agriculture Organization of the United Nations and the International Labour Organization. This Code was designed to promote the safety and health of crew members on board fishing vessels and consists of two parts: Part A (Safety and Health Practice), providing information on the safe conduct of fishing operations, and Part B (Safety and Health Requirements for the Construction and Equipment of Fishing Vessels), providing information on the design, construction and equipment of fishing vessels. The Code applies to fishing vessels of 24 m in length and above and is not a mandatory instrument.

Part A of the Code advises that the formation of ice on a vessel is dangerous and should be reduced by all practicable means and contains in appendix 10 (Recommendation for skippers of fishing vessels on ensuring a vessel's endurance in conditions of ice formation) information on the causes of ice formation and its influence on the seaworthiness of the vessel and recommendations for skippers on how to deal with ice formation, including lists of equipment and tools for combating ice formation and of additional personal protective clothing.

Part B of the Code contains in Chapter III (Stability and Associated Seaworthiness), Section 3.8 (Ice Accretion), provisions for icing allowance to be made in stability calculations for fishing vessels operating in areas where ice accretion is likely to occur. There also are *Voluntary Guidelines for the Design, Construction and Equipment of Small Fishing Vessels* that apply to fishing vessels between 12 and 24 m in length, containing provisions for combating ice formation similar to those in the abovementioned Code.

23.11 Conclusion

The safety of ships operating in the harsh, remote and vulnerable polar areas and the protection of the pristine environments around the two poles have always been a matter of concern for IMO and many relevant mandatory requirements, provisions and recommendations have been developed over the years. Trends and forecasts indicate that polar shipping will grow in volume and diversify in nature over the coming years and these challenges need to be met without compromising either safety of life at sea or the sustainability of the polar environments. The IMO membership is ready to meet these challenges, following the motto of IMO*: "safe, secure and efficient shipping on clean oceans."*

The work on the development of a mandatory Polar Code continues these days and, as many additional and unforeseen issues emerged, the target completion year was extended to 2014. At this stage, it is not entirely clear what form and shape the final mandatory Code will take (i.e., whether existing instruments will be amended or whether a completely new mandatory instrument for polar regions will be developed). In any case, mandatory requirements for these regions are long overdue and urgently awaited by many stakeholders.

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Chapter 24
The Challenges of Oil Spill Response in the Arctic

Staff Working Paper No. 5, National Commission on the BP Deepwater Horizon Oil Spill and Offshore Drilling

Abstract This staff working paper describes some of the difficulties of spill response in the Arctic.[1] In the staff's view, response challenges in the Arctic are important for the Commission to consider in its recommendations for the future of offshore drilling. This paper provides background information regarding the status of offshore drilling in Arctic waters, identifies problems with responding to oil spills in Arctic waters, and highlights areas for further Commission inquiry with respect to Arctic drilling.

24.1 Background

24.1.1 The Region at Issue

The two locations of offshore drilling in the Arctic, the Beaufort Sea and the Chukchi Sea, present different drilling conditions and response issues.

The existing Beaufort Sea drilling sites are situated on man-made gravel islands located 2–15 miles offshore, in water depths up to approximately 39 feet.[2] They are

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This Staff Working Paper (No. 5) of the *National Commission on the BP Deepwater Horizon Oil Spill and Offshore Drilling* was released into the public domain originally on 6 October 2010 and updated 11 January 2011 (http://www.oilspillcommission.gov/resources#staff-working-papers; accessed 25 August 2011). Staff working papers (which *"may be freely distributed and copied"*) were written by the staff for the use of members of the Commission. They do not necessarily reflect the views of the Commission or of any of its members. In addition, they may be based in part on confidential interviews with government and non-government personnel. This staff working paper provided the basis for the NATO Advanced Research Workshop presentation by Chief Coastguard Roderick Johnson (from the United Kingdom, representing the North Atlantic Coast Guard Forum) and is reproduced herein with the original footnotes re-formatted as endnotes to be consistent with other papers in this book.

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often linked to onshore facilities and are close to land and shoreline resources. The majority of the construction of the offshore gravel islands, however, needs to be completed during the winter ice season when an ice road exists between the site and the mainland.[3]

The locations of drilling interest in the Chukchi Sea are much further offshore and, consequently, much less accessible. This area had until recently generated less interest from industry as a result of its lack of shoreline infrastructure and the consequent heightened cost of drilling.[4] The current applications from the Shell Oil Company and Statoil are for seismic exploration and exploratory drilling at least 60 miles off the coast that would take place during the open water season from July to October.[5]

These differences in environmental conditions and drilling proposals mean that spill response for the nearshore drilling sites in the Beaufort Sea would potentially be more straightforward than spill response for the proposed sites in the Chukchi. The nearshore Beaufort region has more developed and proximate infrastructure, so access to a spill area might be easier. However, the existing Beaufort drilling sites are closer to both the sensitive shoreline and the areas traversed by bowhead whales and whale hunters.[6]

A spill or blowout in the Chukchi Sea area would be more difficult to access, let alone contain and clean up. Although Shell has pre-positioned assets dedicated to potential spill response in the Chukchi Sea,[7] bringing any assets, both the pre-staged equipment and any additional resources brought from elsewhere, to bear on a spill in the Arctic would be more difficult than in the Gulf of Mexico. And once the winter freeze occurs, any spill would be impossible to access for purposes of response. On the other hand, any spill in the Chukchi Sea would be far from coastal resources, and oil trapped beneath sea ice would be unlikely to spread into marine ecosystems until the ice began to melt.

The Arctic areas also stand in contrast with the Gulf of Mexico in terms of the issues posed by deepwater drilling. The Deepwater Horizon containment efforts were complicated immensely by the depth of the wellhead and the high well pressures encountered at the Macondo well. Wells in both the Chukchi and the Beaufort Seas would be in far shallower water, which could make it easier to contain a blowout or riser leak. Shell asserts that well pressures in the Chukchi and Beaufort Seas would be approximately one-third to one-half of the pressures faced by BP at the Macondo well.[8] Finally, although wells in the Chukchi would be similar to the Macondo well in terms of distance from shore, the human uses of the shoreline of the Gulf Coast are much more expansive than the human uses of the North Slope Coast.[9]

The contrasts between these regions and between open water and ice conditions affect the nature of spill response and spill response planning. Many of the issues highlighted in this paper apply to both the Beaufort and the Chukchi Seas, but the different conditions should be kept in mind.

24.1.2 Industry Interest

Although interest in exploring Alaska's North Slope for oil began in the early twentieth century, the region's remoteness and lack of land availability prevented serious private investment, leaving most exploration to the U.S. Navy. It was the discovery of the Prudhoe Bay and Kuparuk River fields from 1967 to 1969 that spurred the industry to explore the Arctic region of Alaska.[10] In 1979, the government conducted a leasing sale that included state and federal waters of the Beaufort Sea, resulting in the first major venture into Arctic offshore exploration.[11]

Drilling in the Beaufort began in 1981, with a total of 20 wells drilled by 1989. Only a few of the wells were further developed, including those in the Northstar and Liberty fields. Most of the wells drilled in the Beaufort came up dry. Among the dry wells was the Mukluk well, which, at a cost of $120 million, is considered the most expensive dry well ever drilled.[12] In the Chukchi, remoteness and harsh conditions continued to discourage industry activity. The first lease sale in the area was not held until 1988.

In the 1990s, industry's interest decreased in both the Chukchi and the Beaufort, in part because of the failure of Mukluk. But more recently, interest, in particular, by Shell, has begun to grow once again. Several factors have contributed to renewed oil industry interest in drilling in the Beaufort and Chukchi Seas. Improved technology has made remote locations more economically viable to explore. Additionally, the then-Minerals Management Service (MMS)[13] issued new information for the Burger field in the Chukchi Sea in advance of the lease sales held in 2008, which detailed significant untapped oil and gas resources and made the region much more attractive for exploration and investment.[14] The U.S. Geological Survey, also in 2008, released a reevaluation of Arctic potential resources, estimating that "90 billion barrels of oil, 1,669 trillion cubic feet of natural gas, and 44 billion barrels of natural gas liquids may remain to be found in the Arctic, of which approximately 84 percent is expected to occur in offshore areas."[15]

Shell estimates that there are 25 billion barrels of oil in the Alaskan Arctic, with the majority in the Chukchi Sea; the data from U.S. Bureau of Ocean Energy Management, Regulation and Enforcement (BOEMRE), which accounts only for oil that is economically recoverable with current technology, is 0.15–12 billion barrels of oil in the Chukchi.[16] Shell acquired leases in the Beaufort during Lease Sale 195 in 2005 and in the Chukchi during Lease Sale 193 in 2008, and it has announced plans to drill in both regions. Shell's proposal for drilling exploratory wells in the Chukchi Sea envisions operations taking place from approximately July 15 to October 31. Drilling will occur from a floating drillship. If Shell begins production at some time in the future, production drilling will occur year-round, though access to the drilling operations by boat will be easier during open water season.

The shrinking Arctic ice cap is also a factor. A smaller ice cap creates longer open water seasons and increased open water areas, while diminishing risk of ice collisions.[17] The Arctic Ocean is subject to regular freezing and melting in the winter and summer months. The ice seasons consist of: "open water" in the summer, "freeze up" as the ice forms through the fall, "over winter" as the solid floating ice attaches to the shelf, and “break up” as the ice melts and cracks into floes and other large pieces through the spring. As the temperatures in the Arctic increase, both the extent of ice cover overall and the length of time that ice blocks the sea decreases. Estimates vary as to how soon the Arctic Ocean will be ice-free in the summer months, but most projections place the event sometime between 2030 and 2100.[18]

24.1.3 Status of Exploration and Leasing

The Beaufort and Chukchi Seas sit in different positions with regard to where, how, and when exploration and drilling may occur. All drilling in the Arctic is on pause as of this writing. On September 3, 2010, during a trip to Alaska, Secretary of the Interior Ken Salazar announced that the Department of the Interior will not decide whether to allow exploratory drilling for oil and gas in the Alaska Arctic Outer Continental Shelf until the Department has completed a review of issues relating to offshore drilling activities.[19] On September 9, 2010, the state of Alaska sued the Department of the Interior in the U.S. District Court for the District of Alaska, contending that the announcement imposed an improper de facto moratorium and did not give the state a chance to comment or a final decision to appeal.[20] An Interior spokesperson indicated that the Department was “taking a cautious approach” and needed “additional information about spill risks and spill response capabilities.”[21] The Department also contends that there is no moratorium in place for Alaska, but rather a period of additional review of proposed drilling plans.[22]

24.1.3.1 Beaufort Sea

Pioneer Natural Resources, Eni Petroleum, Shell, and BP all have interests in the Beaufort Sea. All existing offshore fields in the Beaufort Sea are either fully or partially based on artificial offshore islands, though there are proposed drilling sites farther offshore which will require the use of drillships.

Pioneer Natural Resources was the first independent company to control a producing field in the Beaufort Sea. It has been extracting oil in the Oooguruk offshore field since 2008 in partnership with Eni. The site is located on an artificial gravel island 5 miles offshore in 4.5 feet of water.[23] Italy’s Eni has gradually relinquished some of its onshore leases and has instead focused on developing its near-shore Nikaitchuq field in the Beaufort Sea. Eni plans initially to produce oil through an onshore base and later to construct an offshore island and continue production from the water. The company has also teamed up with Shell to conduct seismic tests in the Harrison Bay area of the Beaufort.[24]

BP operates three offshore fields in the Beaufort Sea: Northstar, Endicott, and Liberty. All of them are constructed on man-made gravel islands in the Beaufort Sea waters. The first two fields are older operations, while Liberty was set to begin operating this summer. Liberty is of particular note because it is an ultra-extended reach well. Although it will be drilled in fairly shallow water within 3 miles from shore on state submerged lands, the well will extend laterally for up to 8 miles from the surface location of the drilling rig.[25] In light of the Deepwater Horizon spill, federal regulators have decided to review BP's plans before allowing BP final permission to drill at Liberty.[26] On November 30, 2010, BP decided to suspend work on Liberty for an indefinite time as a result of construction issues.

MMS proposed additional lease sales in the Beaufort Sea in its 2010–2015 draft proposed 5-year leasing program.[27] The National Oceanic and Atmospheric Administration (NOAA) commented on this plan, raising issues related to the impacts of off shore oil exploration and development on living marine resources and their habitats. It also conveyed its concern about the lack of oil spill response preparedness in the Arctic and encouraged leasing to be delayed pending additional research.[28] President Obama's March 31, 2010 announcement of a new Outer Continental Shelf policy cancelled some leases under the 2007–2012 leasing plan and delayed implementation of the proposed 2010–2015 plan to 2012–2017. The 2012–2017 plan is in its early stages of development, and will evaluate whether or not to lease areas in the Beaufort and the Chukchi Seas. Public meetings to determine the scope of the environmental impact statement and the areas to be considered in the 5-year leasing program were scheduled for the summer of 2010, but were cancelled in light of the Deepwater Horizon spill.[29]

24.1.3.2 Chukchi Sea

The 2008 sale of Lease Area 193 in this region proved to be the most profitable in the history of Alaska offshore leasing. Companies bid a total of $2.6 billion for the available lease areas. Lease Sale 193 encompasses approximately 29.4 million acres of the Outer Continental Shelf in the Chukchi Sea. In 2008, seven companies bid for leases: ConocoPhillips, Shell Gulf of Mexico, StatoilHydro USA E&P, the Northern America Civil Recovery Arbitrage Corp, Repsol E&P USA, Eni Petroleum, and Iona Energy Company.[30]

Shell is the only company that has presented plans to drill in the Chukchi (after conducting seismic studies there in 2006 and 2007). It received preliminary permits to drill up to three wells during the summer of 2010. A coalition of Alaska Native and environmental groups challenged the adequacy of the environmental review of the lease sale, contending that the Final Environmental Impact Statement had not fully examined impacts on the environment and human communities. On July 21, 2010, the U.S. District Court for the District of Alaska agreed and remanded the Environmental Impact Statement to BOEMRE for a more thorough environmental impact analysis.[31] On August 2, 2010, the court amended its ruling and allowed non-drilling activities to continue, granting Shell and Statoil permission to conduct seismic tests in the Chukchi Sea during the remainder of the 2010 summer.[32] (Drilling activity had previously been halted by Secretary Salazar's announcement on May 27, 2010 of a 6-month moratorium.)

Shell spent $2.1 billion for its 275 lease blocks in the Chukchi in 2008.[33] A leaseholder can have a tract for up to 10 years but then must have a development plan in place or the Secretary of the Interior will cancel the non-producing lease.[34] Shell has used up three of those years on its Chukchi sites. Even if the exploratory drilling occurs in the Chukchi and is successful, Shell predicts that another 10–15 years would pass before production begins.[35]

As with the Beaufort Sea, NOAA's comments on recent proposed lease sales in the Chukchi expressed the view that no leasing should occur in the Chukchi Sea without additional research on oil spill response.[36]

24.1.4 Overview of Applicable Regulatory Requirements Related to Spill Response[37]

24.1.4.1 BOEMRE and Alaska Regulations

BOEMRE and Alaska Department of Environmental Conservation regulations require an applicant for a permit to conduct offshore exploration or production to provide information regarding its response capabilities. BOEMRE requires an emergency response action plan, which identifies, among other things, a spill management team, a planned location for a spill-response operations center, and an identification of procedures to be followed in the event of a spill.[38] The plan must also include a worst-case discharge appendix.[39] In addition to information about the potential volume, trajectory, and impacted areas in a worst-case discharge spill, the appendix must include a discussion of the potential response to the worst-case discharge scenario in adverse weather conditions. This discussion requires a description of the response equipment; its type, location, and quantity; the amount of time to move the equipment to the spill; and capability, including effective daily recovery capacity. Adverse weather conditions are defined elsewhere in the regulations and "include, but are not limited to: Fog, inhospitable water and air temperatures, wind, sea ice, current, and sea states."[40]

Alaska regulators may additionally require an applicant for a permit for an exploration or production facility to "account for variations in seasonal conditions" and "provide response scenarios for a discharge of the applicable response planning standard volume under typical summer environmental conditions and typical winter environmental conditions."[41] Alaska regulations also specify how much response equipment, including boom, skimmers, and personnel, must be carried, while noting that these are minimum planning requirements, not what may be actually required to respond to a spill.

In the wake of the Deepwater Horizon disaster, Alaska is conducting an analysis of the state regulations regarding offshore drilling. Additionally, the Alaska Oil and Gas Conservation Commission[42] has put together a commission to review offshore drilling practices and ultra-extended reach wells.[43] The Commission put out a public notice on June 24, 2010, seeking public comment on the current requirements regarding well blowout prevention and well control and their possible expansion, including whether the Commission should require "operators drilling offshore or ultra-extended reach wells to demonstrate the ready capability to drill a relief well if necessary."[44] The review is focused on source control and does not appear to be investigating spill response issues. The Division of Oil and Gas, within the Alaska Department of Natural Resources, is evaluating its own rules and requirements to determine whether the existing authorities regulating petroleum are sufficient. That study may be completed as early as this September.[45]

24.1.4.2 Shell's Chukchi Sea Regional Exploration Oil Discharge Prevention and Contingency Plan

A review of Shell's Chukchi Sea Regional Exploration Oil Discharge Prevention and Contingency Plan ("Shell C-Plan") illustrates some of the current requirements and the level of detail provided to meet them. Shell is the only company to have made a proposal for drilling in the Chukchi, so there are unfortunately no competing plans with which to compare the response plans Shell proposes. This paper's brief discussion of Shell's proposal is not meant to be comprehensive.[46]

Because Shell's proposal is for exploratory drilling, rather than production, it is subject to different requirements than those for producing wells.[47] BOEMRE regulations require an exploratory drilling operation to calculate a worse-case discharge scenario lasting 30 days, and to provide a response plan for that scenario.[48] The worst-case discharge is the daily volume possible from an uncontrolled blowout.[49] The state regulations require an exploration facility to plan for a release of 16,500 barrels, and an additional 5,500 barrels for each of 12 past 72 hours in the case of a blowout.[50] Shell's final C-Plan includes response plans for a discharge of 5,500 barrels for 30 days, for a total release of 165,000 barrels.[51]

With regard to risks from loss of well control, Shell believes that "a prudent operator can conduct a Chukchi Sea drilling program using a single drillship," which would "relocate to a safe location to initiate a relief well" in the event of a blowout.[52] Shell estimates that it could drill a relief well in as few as 16 days or as many as 34 days. Shell's preferred method for containing a blowout is the use of dynamic surface control measures.[53] The plan, which Shell indicates is accepted as best available technology, is to pump fluid down the well casing and circulate the fluid at a sufficient rate to create friction, which will match or exceed the reservoir pressure and stop the flow.[54] Shell states that it would likely not be able to use a well-capping technique because of the nature of the well. It notes that "[w]ell capping is not feasible for offshore wells from moored vessels with [the blowout preventer] sitting below the mudline."[55] Because of this limitation, the C-Plan asserts that Shell would immediately mobilize to drill a relief well in the event of a blowout.

Since the Deepwater Horizon event, Shell has added to its plan a proposal to build a containment system similar to that built to control the Macondo well. It plans to store a containment dome and containment recovery system at a port in Alaska and to deploy it in the event of a subsea spill.[56]

The Shell C-Plan notes that, in addition to the Shell-operated response equipment and response teams, Alaska Clean Seas would be used as the primary contractor. Alaska Clean Seas is a non-profit oil spill removal organization whose members are companies exploring or drilling on the North Slope or on the Outer Continental Shelf.[57] (A similar oil spill removal organization, Clean Gulf Associates, exists for the Gulf of Mexico.) The Arctic Slope Regional Corporation also runs an additional oil spill removal organization. In the event of a blowout, Shell proposes to call on Wild Well Control, Inc., a well-control specialist.[58]

Shell notes that recovery of the spilled oil would be limited by the presence of ice, and the plan anticipates that during freeze-up conditions, some oil would become encapsulated by the ice. Shell states that it would monitor and track such oil, and that "response strategies and specific tactics will be modified to accommodate the challenges of working with a variety of potential ice conditions."[59] Within the context of each response strategy discussed in the plan, Shell acknowledges some of the limitations that the presence of ice creates. As discussed in greater depth below, it is likely that non-mechanical response strategies such as in situ burning would play a large role in any response.

MMS conditionally approved Shell's exploration plan (as distinguished from the C-plan) on December 7, 2009.[60] MMS found that Shell's plans for "responding to a blowout, loss or disablement to the drilling unit, or loss of or damage to support craft," complied with a regulation specific to Alaska offshore projects requiring emergency plans, and included, as required, accompanying procedures for critical operations and curtailment.[61] However, MMS required that Shell "provide documentation on the availability of suitable alternative drilling unit(s) that would be made available to Shell should it be necessary to drill a relief well."[62] Shell has identified an additional drillship that could be mobilized to begin drilling a relief well, the Kulluk drilling unit, likely to be stored at Dutch Harbor in the Aleutian Islands in southwest Alaska.[63]

Shell's initial C-Plan was submitted in May 2009.[64] MMS gave its conditional approval on December 18, 2009.[65] Both MMS and Alaska regulators required Shell to submit additional information on several response issues, such as where response equipment would be pre-staged, the estimated mobilization times for spill response equipment, a copy of its contract with oil spill response operators for dispersant support, and the length of time it would take Alaska Clean Seas to transport response support from Prudhoe Bay to the Chukchi sites.[66] MMS also required Shell to conduct contingency plan exercises, including a tabletop drill addressing the worst-case discharge scenario, and deployment exercises demonstrating the capacity to carry out the response activities described in the plan. Shell submitted a revised plan in March 2010.[67]

On April 6, 2010, MMS gave final unconditional approval of the Shell C-Plan, finding that the requested information had been provided. In a news interview after the Deepwater Horizon spill, BOEMRE spokesperson John Callahan said, "The Alaska Region [of BOEMRE] can confirm that it reviewed Shell's contingency plan and found it adequate for the time it was issued. However, in light of the BP oil spill in the Gulf and new requirements for the plans, we will be reviewing the adequacy of the current version of the project's spill plan."[68]

24.2 Challenges of Spill Response

The Arctic environment poses unique challenges for spill response. Some limitations of existing techniques are discussed below. To the extent the Shell C-Plan seeks to address these issues, Shell's proposed method of adapting to the limitations is described.

24.2.1 Adverse Weather

The presence or absence of ice is a large factor in the ability to respond to a spill, but it is not the only environmental factor affecting spill response. Temperature affects the consistency of oil and the speed at which it degrades. Winds and the resulting wave action are another factor. High energy from wind and waves can help oil to disperse naturally, but this energy also breaks up a thick slick into multiple thinner slicks, which are more difficult to address. Also, in broken ice, waves are less effective at naturally dispersing oil.[69]

Weather, including wind and wave activity, also affects responder access to an oiled area and whether recovery strategies such as boom and skimmers will work. Adverse weather conditions prevented responders from collecting oil from the wellhead, employing mechanical recovery methods, and conducting in situ burns at times during the Deepwater Horizon response. Seasonally short Arctic days and the prevalence of fog and storms also limit the amount of time when response is feasible. Sea state may be calmer in the Arctic than in the Gulf, as the sea ice has a muffling effect on waves. However, the water may grow turbulent over time as the summer ice melts and wave activity increases.[70]

The amount of time when responders are simply unable to work is known as the response gap, and it is based on, among other things, adverse weather conditions. A study of response capabilities in Prince William Sound attempted to quantify the response gap in that region.[71] Researchers identified when response efforts would not be possible based on their investigation of when environmental conditions would cause mechanical recovery systems to fail. For example, they concluded that response efforts would not be affected by wind speeds of less than 21 knots, would be impaired but possible in speeds between 21 and 30 knots, and would not be possible in winds of over 30 knots. They then used 6 years of hourly wind, sea state (a measure which includes wave height and wave period), temperature, and visibility data from two locations in Prince William Sound to evaluate the length of time that environmental conditions exceeded response operating limits.[72] They eliminated any days when the locations in the Sound were closed to tanker traffic. The study found that, considering all the environmental limitations together, response operating limits were exceeded, and response was not possible, 38% of the time. That figure rose to 65% of the time during the winter season.[73]

It does not appear that a similar comprehensive response gap analysis has been conducted for the Arctic.[74] However, the Shell C-Plan notes that temperature alone would be a significant limitation. All non-emergency work stops when temperatures fall below −45°F, and, according to Shell, response efforts would be limited by temperatures below −20°F, which would occur 50% of the time in the month of January and 64% of the time in the month of February.[75]

24.2.2 Locating the Oil

One of the main challenges for oil spill responders in Arctic waters is the problem of locating oil. Oil spilled into broken ice will tend to move with the ice.[76] Oil is also more difficult to locate if it moves under ice floes or becomes encapsulated into surrounding ice. Visual observations are not an adequate means of detection, as the oil is generally hidden from view beneath the ice. In 2009, then-MMS published a report entitled "Arctic Oil Spill Response Research and Development Program: A Decade of Achievement."[77] This paper chronicles issues and advances in oil spill response in the icy Arctic environment. In the paper, MMS noted that the "ability to reliably detect and map oil trapped in, under, on, or among ice is critical to mounting [an] effective response in Arctic water."[78]

The existing method for locating oil in or under ice involves drilling holes in a grid through the ice to detect oil underneath. This method is expensive, dangerous, and not always possible based on ice conditions. MMS has conducted several research studies aimed at evaluating potential solutions to this problem. Ground penetrating radar (GPR) is one technology viewed as having potential.[79] GPR units can be used by personnel walking on the ice or can be mounted on helicopters flying over the ice at a very low altitude.[80] According to MMS's GPR laboratory and field-testing, the technology can detect oil slicks that are at least 2 centimeters (2.54 cm equals 1 inch) thick in or under 1–3 feet of ice when used from a helicopter and up to 7 feet of ice when a hand-held unit is used.

Though GPR represents an advance over the drilling method, many factors limit its usefulness. MMS's field test report acknowledges that "[d]etection of oil under ice through multi-year ice or rafted/ridged first-year ice might be difficult or impossible."[81] Other types of rough or pocketed ice will pose similar difficulties. Additionally, though oil slicks may tend to be thicker in the Arctic environment than in other places as a result of the cold temperatures, the oil is still likely to spread out, making the ability to detect only slicks that are more than 2 cm thick a serious limitation. Though researchers indicate that the technology has promise, the responder may still need to start out with a basic sense of where the oil is in order for GPR to be of use.

The Shell C-Plan acknowledges that tracking a spill through ice might be necessary. Shell indicates that it could track the oil with drift buoys, radar reflectors, flags, GPR, and laser fluorosensors.[82] In the section on planning for a release in winter pack ice, the Shell C-Plan states that "[p]romising results of tests with Ground Penetrating Radar and other remote-sensing systems could lead to the development and refinement of detection and tracking techniques for oil that is trapped deep within a thick ice layer." The C-Plan goes on to predict that such trapped oil could be dealt with through a "leave in place" strategy, discussed below.[83] It does not appear that MMS had any comment on this aspect of the plan when the agency approved the C-Plan.[84]

24.2.3 Mechanical Recovery Technology

In addition to acting as a barrier to detection, ice also poses a physical barrier to mechanical containment and response efforts. Boom and skimmers, which are often deployed in tandem as part of early response efforts, are not very effective in broken ice conditions.[85] For any mechanical recovery technology to work, it needs to "encounter" the oil, which means that the oil needs to be grouped together in a thick enough slick for the recovery system to separate the oil at the surface from the water.

Boom is difficult to deploy through broken ice. MMS notes that boom is "of little to no use in large moving ice floes or in ice concentrations greater than 30%."[86] Boom for use in the Arctic also must be made of a durable material that can withstand impacts from pieces of ice.

Skimmers can become clogged with ice and slush, and they need to be positioned between ice floes, which may not always be possible. Additionally, a skimming vessel will break up ice floes, moving the natural ice barrier and letting the oil spread out, thus making it harder to skim.[87] The oil that is skimmed will still likely contain pieces of ice. Although some advances in the material used to make skimmers, such as the development of grooved skimming drums, have improved skimmer efficiency in ice conditions, overall skimming potential is limited by the presence of ice.[88]

If the ice cover is too great, and mechanical recovery is not possible, it may be necessary to let the oil become incorporated into the ice and deal with it when the ice melts.[89] MMS notes: "For high ice concentrations of 8/10 or more, most of the spilled oil (especially from a subsea blowout) will become immobilized or encapsulated within the ice . . . . Oil encapsulated within the ice is isolated from any weathering processes (evaporation, dispersion, emulsification). The fresh condition of the oil when exposed (e.g. through ice management or natural melt processes) enhances the potential for in situ burning." This strategy effectively requires responders to leave oil in place but somehow track it, so that they can attempt to remove it once it is freed from the ice but before it re-enters the marine environment. This is sometimes referred to as "mining" of oil.[90] In the interim, the oil is unlikely to degrade, making it more susceptible to burning but less likely to be reduced in amount by natural processes.

This “leave-in-place” strategy does not appear to have been used during an actual spill, though it is the subject of research. The Shell C-Plan indicates that this strategy might be used for a spill in early winter. The plan predicts that “[t]ypically, within a day or two, new ice would completely surround the oil, encapsulating, immobilizing and preserving the condition of the oil. The ice-encapsulated oil can be marked and tracked for removal when the ice is safe to work on, or the oil could be tracked until spring. At that time the oil would become exposed at the surface through brine-channel migration or through surface melt down to the small entrapped oil droplets.”[91]

The behavior of oil in ice is an important topic of research.[92] According to researchers, the accepted view is that oil becomes encapsulated as ice forms around it. As the ice begins to melt, the oil is transported through the ice to the surface of the ice through brine channels, which are paths through the ice where salt is very concentrated.[93] However, newer research calls this assumption about transportation up to the surface into question, and there remain unknowns about the role of brine channels as a pathway for marine exposure to oil. Questions remain about whether oil may be pulled into the brine channels and, rather than moving to the surface of the ice, move down through the ice and into the water column.[94]

The Shell C-Plan comments on the difficulties of using mechanical response technologies in icy conditions. The plan notes that even low concentration of individual ice floes “can obstruct containment or deflection boom, prevent oil from accumulating in large pools, and block the flow of oil toward a recovery device.”[95] Shell explains that, though it will modify mechanical response tactics to suit the Arctic environment, as ice concentrations increase, non-mechanical tools such as in situ burning and dispersants (both discussed below) will become more practical.[96]

24.2.4 In Situ Burning

In situ burning is another response technique that was used in the Deepwater Horizon response and would be used in any Arctic oil spill response. This strategy requires gathering the oil either with fireproof boom or between natural ice berms. It also requires that the oil not be overly weathered. Burning is an important strategy in the Arctic, where there is less risk of having a fire spread out of control. Additionally, there is potentially less concern about the negative air quality impacts of burning as there are lower concentrations of people and wildlife that could be affected. Moreover, oil mixed with some ice, snow, or slush can still burn.

Burning in the Arctic, however, is not without difficulty. In order to stage the fire-proof boom, vessels must be able to access the area and boom must be pre-staged for quick deployment. Oil is more difficult to ignite at lower temperatures. Chemical “herders” may be required to gather and thicken the oil, but no commercially-produced herders are currently approved for use in Arctic waters.[97] Oil that enters the water column before hitting the surface, such as from a subsea pipe leak or blowout, will be more likely to become emulsified and spread out once it reaches the surface and will therefore be harder to burn. Because of the propensity of oil to spread, in situ burning is a technique that will work best with a rapid response.

As with all response techniques, the efficiency of in situ burning will vary widely. Efficiency will largely depend on how much of the oil can be contained and burned. For example, in a 2006 experiment in Norway that simulated a tanker spill, 96% of the oil that surfaced was successfully burned,[98] but in a 1998 well blowout study in situ burning accounted for only 3.4–6.4% of the total volume of oil spilled in fall freeze-up conditions on open water.[99]

The Shell C-Plan takes a positive view of in situ burning, asserting that "the consensus of research" is that it is an "effective technique with removal rates of 85 to 95 percent in most situations."[100] The C-Plan describes difficulties associated with ice, but also suggests that ice may assist burning by containing the oil, dampening wave action, and reducing the propensity of the oil to spread out in a thin layer.[101] Shell does not estimate the percentage of days that wind and wave conditions would likely prevent in situ burning.

24.2.5 Chemical Countermeasures

Dispersants were used extensively in the Deepwater Horizon response and are often a critical component of oil spill response. However, their potential Arctic use is limited by uncertainty over their effectiveness and toxicity in that environment.

Dispersant effectiveness depends on the properties of the oil, the amount of weathering that has taken place, and the energy available to mix the dispersants into the oil. Aerial spraying can occur even during broken ice or bad weather conditions, but mixing might be reduced. Application by boat can increase mixing as the vessel churns up the water, but requires a boat capable of traveling in the ice and appropriate weather. Once the oil is encapsulated into or emulsified with the water, dispersants are unlikely to be effective. A 2001 study commissioned by the Prince William Sound Regional Citizens' Advisory Council found that dispersants were less than 10% effective when applied to Alaska North Slope crude oil spilled on water at the temperature and salinity common in the estuaries and marine waters of Alaska.[102] The study found that temperature had a strong effect on the behavior of the oil, which in turn affected dispersant effectiveness. However, an MMS/ExxonMobil-sponsored project, based on testing at Ohmsett, the National Oil Spill Response Test Facility in New Jersey, concluded that dispersants could be effective in cold water.[103] This study estimated dispersant effectiveness at a range of 82–99%. More research is needed regarding dispersant effectiveness in situations involving ice cover, heavy wind conditions, and weathered oils.[104]

Concerns about dispersant toxicity in the Arctic are similar to concerns about dispersant toxicity generally. One Arctic-specific issue is the speed of biodegradation of dispersed oil. Dispersants break down oil into smaller droplets, which may then be more easily biodegraded by oil-consuming bacteria.[105] Oil-consuming bacteria are present in Arctic waters, but they may break down dispersed oil more slowly than in warmer waters.[106] As a result, dispersed oil may be present in the ecosystem for a longer period of time. Moreover, concerns about the long-term fate and effects of dispersed oil in the Arctic are potentially magnified because of the lack of baseline data about the environment.

The Alaska Regional Contingency Plan sets out dispersant guidelines.[107] Within the Alaska plan, the North Slope Subarea Contingency Plan sets out the decision-making process for the use of dispersants and requires the Federal On-Scene Coordinator to consult the guidelines before authorizing dispersant use.[108] The Federal On-Scene Coordinator must "examine conventional response alternatives, such as containment and cleanup, for comparison to dispersant application" and may consider dispersant use only "when an effective conventional response is not feasible or not totally adequate in containing/controlling the spill."[109]

Shell's dispersant plan for Chukchi exploration is to store 25,000 gallons (gal) of Corexit 9500 in Anchorage and pre-stage another 1,300 gal with Alaska Clean Seas on the North Slope.[110] The Shell C-Plan contends that "[d]ispersant use is a rational approach to mitigate environmental impacts from spills when sea states or other factors limit or negate conventional countermeasures."[111] The plan suggests that, because mechanical recovery and in situ burning opportunities might be limited, dispersants are a valuable option.[112] However, the plan also notes the potential limitations on dispersant effectiveness. It recognizes that because the properties of the oil in the reservoir are unknown, on-site testing would be a condition of dispersant use. The plan also notes that, to be effective, dispersants must be applied to fresh crude before it has an opportunity to emulsify or weather, and that dispersants are less effective on colder, more viscous oil. Finally, Shell states that it would try to avoid applying dispersant on or near sea birds or marine mammals.[113]

24.2.6 Bioremediation and Natural Processes

Oil will degrade in the water over time as it is consumed by bacteria. Bioremediation is "the act of adding materials to contaminated environments to cause an acceleration of the natural biodegradation processes."[114] The National Contingency Plan, which governs oil spill response, specifies that "bioremediation agents" are "microbiological cultures, enzyme additives, or nutrient additives that are deliberately introduced into an oil discharge and that will significantly increase the rate of biodegradation to mitigate the effects of the discharge."[115] Bioremediation may be a potential response strategy in the Arctic, where the temperature and weather conditions otherwise slow the natural biodegradation process.

Responders have used bioremediation techniques in the cleanup of a number of major oil spills.[116] For example, 1 day after the June 8, 1990 spill from the *Mega Borg* off the coast of Texas, the Federal On-Scene Coordinator authorized the use of a bioremediation product on the open-sea oil slick.[117] It was unclear how effective the product was, and this response highlighted the difficulties of open-sea application.[118] Responders applied bioremediation materials – including nutrients, fertilizer, and exogenous bacteria – to the shoreline after the *Amoco Cadiz* wrecked off the coast of France.[119] The approaching tourist season, however, prevented more extensive use in the area.[120]

The most prominent experimentation with onshore bioremediation occurred after the *Exxon Valdez* spill.[121] The level of endogenous oil-metabolizing bacteria had already increased on the Alaska shoreline. Responders decided to promote growth of these endogenous bacteria by adding nutrients and fertilizer to the shoreline of Prince William Sound, instead of seeding the shoreline with exogenous bacteria.[122] This technique was considered successful.[123] As with the *Amoco Cadiz* response, bioremediation in the *Exxon Valdez* response involved shoreline use, rather than use in open water.

There are concerns that low temperatures and the variable salinity in the Arctic will decrease the potential of bioremediation. Research done in Norway, however, suggests that microbial communities located in ice can begin to break down oil.[124] A patent issued in 2001 registers an improved method of administering bacteria to an open-water spill, and a pending patent application filed by a German group discloses a technique specifically aimed at bioremediating open water Arctic spills.[125]

The regulatory framework governing bioremediation processes is complicated. The National Contingency Plan treats bioremediation products similarly to dispersants, with a product schedule and authorization requirements.[126] Twenty-four products are listed on the product schedule. The North Slope Subarea Area Contingency Plan also discusses bioremediation products, and contains a general protocol for testing products listed on the National Contingency Plan schedule for use in Alaskan waters.[127] These products are not preapproved for any use.

24.3 Geographic and Cultural Issues

24.3.1 Response Posture and Readiness

As noted above, the Beaufort and Chukchi Seas are different in terms of response needs. This section focuses mainly on response in the Chukchi, where the distance from shore and lack of infrastructure make access, let alone response, difficult. Some of these concerns do apply to the Beaufort as well. The National Contingency Plan requires the Coast Guard to oversee oil spill planning and preparedness, and to supervise an oil-spill response in coastal waters. Current federal emergency response capabilities in the region are very limited.

Coast Guard officials have noted over the past few years that they are ill-prepared to respond to a major spill in the Arctic.[128] In addition to the response limitations detailed above, the Coast Guard lacks ice-class vehicles capable of responding to a spill under Arctic conditions. The Coast Guard has three polar icebreakers: the *Polar Star*, the *Polar Sea*, and the *Healy*. Both the *Polar Star* and the *Polar Sea* are currently non-operational, and both have exceeded their intended 30-year service lives.[129]

The *Polar Sea*, originally commissioned in 1978, was returned to service in 2006 following a rehabilitation project intended to extend the vessel's service life to 2014.[130] In June of this year the Coast Guard announced that the *Polar Sea* would cease operations until January 2011 due to "an unexpected engine casualty," the cause of which is still under investigation.[131] Another rehabilitation project, budgeted at $60 million and intended to extend the life of the *Polar Star* by 7–10 years, began in 2006.[132] It is expected to be completed in 2013. The most recent Coast Guard estimates suggest that the work required to further extend the lives of the *Polar Sea* and the *Polar Star* would cost about $400 million per vessel (in 2008 dollars), and the cost of replacement ships would be between $800 million and $925 million.[133] The same report predicts that it would take 8–10 years to build the new ships.

The Coast Guard procured the third ship, the *Healy*, in the 1990s, and commissioned it in 2000. The *Healy* was supposed to complement the *Polar Sea* and the *Polar Star* with its greater research support capabilities. It has less icebreaking capability than the other ships.

The funding for operations and maintenance on all of these vessels has come through the National Science Foundation's budget since FY2006, because of the ships' increasing research functions.[134] Should a major drilling program begin offshore in the Chukchi Sea, additional operational polar icebreakers would be required to reach a rig or a spill in icy conditions. Decisions regarding whether to repair the current vessels or to acquire additional ice-class vessels are currently in the hands of Congress and subject to the budgeting process.

Distance is another major hurdle, even in open water and good weather conditions. Though the operators of the lease sites and their contractors will provide response equipment and personnel in the event of a spill, the Coast Guard still must oversee that response. The nearest Coast Guard operations base to the Chukchi region is on Kodiak Island, which is approximately 1,000 miles from the leasing sites. In addition to overseeing spill response, the Coast Guard provides search and rescue capabilities in other areas. Without a presence in the Arctic, it would be very difficult for the Coast Guard to conduct any emergency search and rescue operations.

In the Beaufort Sea, response capability is increased by proximity to the city of Barrow and the shoreline. However, Barrow is still a small community of less than 5,000 people.[135] Wainwright, the second-largest town in the North Slope Borough and on the Chukchi Sea coast, had a population of about 550 at the time of the 2000 census.[136] A major spill would require bringing in responders, but it would be difficult for this region to support a large influx of response personnel. The nature of the sea also complicates the staging of operations. The sea is too shallow at Wainwright to support a full dock, and there is only a boat ramp from which to launch smaller vessels. The nearest dock capable of supporting large vessels is at Prudhoe Bay in the Beaufort Sea.

Shell's plan for exploratory drilling in the Chukchi involves a small flotilla of ships available to assist with response efforts. The Shell C-Plan asserts that an oil spill response vessel will be positioned so that it could arrive at a spill site within

1 hour.[137] It also anticipates that a larger transport vessel will be able to arrive within 24 hours and would be able to store up to 513,000 barrels of oil or oily water. Additional personnel and resources, according to the plan, will be mobilized through the contractor Alaska Clean Seas, which has personnel stationed on the North Slope in Prudhoe Bay and along the Beaufort Sea. They have an advisor on Chukchi exploration issues but do not appear to have any response personnel stationed west of Barrow at present.[138] According to the C-Plan, equipment will be pre-staged at Wainwright, where there is a small airport and a boat ramp from which to deploy the equipment to the spill.

Environmental groups have criticized this plan, asserting that the estimated response times are unrealistic. Pew Environment's U.S. Arctic program has drafted a peer-reviewed report on oil spill response in the Arctic, which includes a response scenario analysis for the Chukchi Sea.[139]

24.3.2 Subsistence Resource Use

Subsistence resource uses provide an important background to any discussion of offshore drilling in the Arctic. Inupiat Eskimos are the dominant population in Alaska's Arctic region and have practiced subsistence hunting and fishing for thousands of years. For most residents of the North Slope, a subsistence-based lifestyle is an economic necessity. The cost of living is high as a result of transportation costs for goods and services. While jobs are available in oil extraction facilities in the Prudhoe Bay area, the per-capita income does not correspond to the high cost of living.[140] The Inupiat are forced to supplement their diet through subsistence hunting and fishing since the harsh weather makes agriculture impossible.[141] Walruses, seals, and caribou make up part of the Inupiat diet, but the bowhead whale is of particular importance due to its size and food potential.

Bowhead whales can reach 60 feet in length and weigh more than 120,000 pounds. They migrate from Russian to Canadian waters and back through the Chukchi and Beaufort Seas. They are the most important subsistence animal for the coastal communities of northwest and northern Alaska.[142] Of the 74% of North Slope Borough households that responded to a 1998 survey, nearly 69% of Inupiat families reported that the bowhead whale makes up more than half of their subsistence food diet.[143]

Whale hunting and the customs surrounding it are also an important part of the cultural heritage of the Inupiat. A 1986 study estimated that 70% of the population of Wainwright, Alaska directly participates in preparing and preserving a whale that has been caught. No other communal activity involves as high a level of participation.[144]

Many coastal Inupiat are strongly opposed to offshore drilling, largely because it can interfere with the migratory patterns and well-being of the bowhead whale. Much of this opposition relates to concerns over seismic activities, which can drive the whales off their normal migratory path.[145] Oil spills present another hazard. In case of a spill, whales may pass through the oil, exposing their bodies to harmful hydrocarbons. No research has studied the toxic effects of inhaled or ingested oil on bowhead whales, but scientists believe the consequences would be similar to those for polar bears and seals, which are both seriously affected by oiling.[146] While no major oil spill has occurred in the Beaufort Sea, concerns about the potentially calamitous effects of a spill on the bowhead whale population are a major factor in any evaluation of offshore drilling.

24.4 Areas for Commission Inquiry

Shell's exploratory drilling C-Plan is currently the only formal industry proposal for contingency planning and oil spill response in the Arctic. While Shell's plan acknowledges many of the challenges of spill response in the Arctic, questions remain as to whether its solutions to those challenges are realistic. The Commission may wish to consider the recent analysis conducted by the Pew Environment Group in evaluating the Shell plan and the requirements for Arctic response plans generally.

The Commission may also want to consider the regulatory standards to which the C-Plan is keyed. The regulations set out requirements for spill response planning, such as the volume for the worst-case discharge scenario and the proximity to the well of spill response equipment. The Shell plan appears to go beyond these standards, but other drillers may not. Environmental groups have criticized the current response planning standards as inadequate because they allow an applicant to underestimate the risk of, and do not require sufficient response capacity in the event of, a worst-case discharge. Bills in both the U.S. House and Senate attempt to respond to these concerns by requiring response plans to include a more comprehensive risk analysis, greater detail about response capability, and specific information on measures to be used in case of a loss of well control.[147] The Commission, after further review of the regulations and an evaluation of the action Congress is considering, may wish to recommend amending the regulations.

The Commission may also wish to consider the resources brought to bear to review contingency plans. The Shell C-plan process, where MMS did request further information in support of the plan, shows that at least some review of the plan took place. The Commission may wish to consider whether the new BOEMRE possesses the expertise, resources, and appropriate incentives to review spill response plans, and whether other agencies should play a role in such review. For example, the Environmental Protection Agency (EPA) and NOAA may possess scientific expertise relevant to the evaluation of Arctic response plans, and the Coast Guard may possess relevant operational expertise.

EPA and NOAA are currently involved in the environmental review process, but could play a larger role in the spill response planning process. Proposed Congressional actions would require the lead agency reviewing the response plan, such as BOEMRE, to obtain the written concurrence of other agencies that have a significant responsibility to remove, mitigate damage from, or prevent or reduce a substantial threat of the worst-case discharge of oil. The Commission may wish to consider this and other mechanisms to incorporate consultation with other agencies into spill response planning.

It is unclear the extent to which and the speed at which the Coast Guard, the oil spill response contractors, and industry could mobilize response equipment and personnel in the event of a spill in the Chukchi Sea. Because the Coast Guard has an admitted lack of response capacity in the Arctic, immediate responsibility would fall on industry and their oil spill response contactors. Shell, at least, accepts this responsibility. One of the questions for the Commission is whether increased Coast Guard capacity should be a prerequisite for offshore activity or whether the government is comfortable with accepting responsible parties (and private contractors) as primary spill responders, especially in light of widespread public concern about BP's role as the responsible party in the Deepwater Horizon response.

The Commission may also wish to consider encouraging research in two areas. First, further research is needed on the dynamics of the Arctic marine ecosystem and the ways in which marine mammals use sea and shoreline resources. Second, further information is required on the effectiveness of common response methods and whether they can be modified for the Arctic environment. The use of dispersants, bioremediation, and more advanced GPR technology should be investigated to improve response capacity. A response gap analysis, such as the analysis conducted in Prince William Sound, may be a useful tool to identify which response mechanisms should be prioritized.

The U.S. Geological Service is presently evaluating the state of scientific knowledge about the Arctic and will identify specific areas for research. The Department of the Interior directed this analysis on April 13, 2010 (a week before the Deepwater Horizon explosion).[148] Potential mechanisms for funding oil spill response research in general are discussed in other work by the Commission and its staff.

Another question the Commission may wish to consider is the role of the local Inupiat community in setting up response infrastructure and assisting with response efforts. The Prince William Sound Regional Citizens' Advisory Council, established after *Exxon Valdez*, has been suggested as a model for incorporating local communities into spill planning and spill response. The Commission may wish to recommend that a similar council be created in the North Slope communities and be funded by industry engaging in offshore activities.

Notes (Footnotes from the original United States government publication)

1. Note that the research and analysis in this working paper has been substantially updated and expanded upon in subsequent work by the Commission and its staff. Note also that this working paper does not address all issues related to Arctic drilling in which the Commission may be interested. For example, the paper does not address the evaluation of spill impacts, the potential non-oil spill impacts of oil and gas development in the Arctic, or the role of environmental regulatory review under the *National Environmental Policy Act*, the *Marine Mammal Protection Act*, and other federal laws (or their Alaska state counterparts).

2. BP IN ALASKA, www.bp.com/assets/bp_internet/us/bp_us_english/STAGING/local_assets/downloads/a/A02_alaska_facts_figures.pdf; SHELL'S BEAUFORT SEA EXPLORATORY DRILLING PROGRAM: OIL SPILL PREVENTION AND RESPONSE, http://www-static.shell.com/static/usa/downloads/about_shell/strategy/major_projects/alaska/final_shell_ospr_booklet_10-1-07.pdf, Ian Urbina, *BP Is Pursuing Alaska Drilling Some Call Risky*, THE NEW YORK TIMES (June 23, 2010).
3. J.D. Hall, *Oooguruk Project Offshore Alaska*, OFFSHORE (Aug. 1, 2008), http://www.offshore-mag.com/index/article-display/337896/articles/offshore/volume-68/issue-8/arctic-frontiers/oooguruk-project-offshore-alaska.html.
4. CHARLES THOMAS, WALTER NORTH, TOM DOUGHTY & DAVID HITE, ALASKA NORTH SLOPE OIL AND GAS: A PROMISING FUTURE OR AN AREA IN DECLINE?, DOE/NETL (Apr. 8, 2009), http://www.netl.doe.gov/technologies/oil-gas/publications/AEO/ANS_Potential.pdf [hereinafter THOMAS ET AL., ALASKA NORTH SLOPE OIL AND GAS].
5. Online Public Notice, State of Alaska, North Slope Borough: Shell Offshore Inc. 2010 Chukchi Sea Exploration Plan (Nov. 25, 2009), http://notes4.state.ak.us/pn/pubnotic.nsf/PNByPublActive/863634D1F5F77240892576780000615E2?OpenDocument.
6. This paper does not address the announcement in October 2010 by the Shell Oil Company that it would seek to drill exploratory wells in the summer of 2011 on offshore leases in the Beaufort Sea.
7. Peter K. Velez, Upstream Emergency Response Manager, Shell International Exploration and Production B.V., Presentation to Commission Staff (Sept. 16, 2010).
8. The Macondo wellhead lay below about 5,000 ft of water; the proposed exploratory wells in the Chukchi Sea would be at depth of about 150 ft. Shell believes, based on the testing it has already done, that the pressures in the Chukchi Sea would be two to three times less than they were in the Macondo well. Letter from Marvin E. Odum, President, Shell Oil Company to S. Elizabeth Birnbaum, Minerals Management Service (May 14, 2010), *available at* http://www.thearcticsounder.com/article/1020shell_letter_defends_arctic_program_in_light.
9. Some of the shoreline and human use issues relating to the Gulf of Mexico and the Chukchi and Beaufort Seas are discussed in other work by the Commission and its staff on the potential impacts of the spill.
10. THOMAS ET AL., ALASKA NORTH SLOPE OIL AND GAS at 2–17 to 2–25.
11. *Id.* at 2–26.
12. *Id.* at 2–35.
13. MMS is now the Bureau of Ocean Energy Management, Regulation and Enforcement (BOEMRE).
14. THOMAS ET AL., ALASKA NORTH SLOPE OIL AND GAS at 2–79.
15. Fact Sheet, U.S. Geological Survey, Circum-Arctic Resource Appraisal: Estimates of Undiscovered Oil and Gas North of the Arctic Circle (2008), *available at* http://pubs.usgs.gov/fs/2008/3049/.
16. Shell Beaufort and Chukchi Sea, Program Update, Presentation to Commission Staff (Sept. 17, 2010); Questions and Answers: The Next Five-Year OCS Oil and Gas Leasing Program (2012–2017), http://www.doi.gov/whatwedo/energy/ocs/QA_2012-2-17.cfm.
17. RONALD O'ROURKE, CONGRESSIONAL RESEARCH SERVICE, CHANGES IN THE ARCTIC: BACKGROUND AND ISSUES FOR CONGRESS 17 (Mar. 30, 2010).
18. *See, e.g.*, Press Release, National Snow and Ice Data Center, Arctic Sea Ice Shatters All Previous Record Lows (Oct. 1, 2007), *available at* http://nsidc.org/news/press/2007_seaiceminimum/20071001_pressrelease.html (predicting 2030); Walter Meier, Julienne Stroeve, and Florence Fetterer, *Whither Arctic Sea ice? A Clear Signal of Decline Regionally, Seasonally and Extending Beyond the Satellite Record*, 46 ANNALS OF GLACIOLOGY 433 (2007): (predicting 2035–2106); Julienne Stroeve, Marika Holland, Walt Meier, Ted Scambos, and Mark Serreze, *Arctic Sea Ice Decline: Faster than Forecast*, 34 GEOPHYSICAL RESEARCH LETTERS 5 L09501 (2007) (predicting 2050–2100).

19. Kim Murphy, *Salazar Says Arctic Drilling Must Wait Until More Is Known About Potential Pitfalls*, LOS ANGELES TIMES (Sept. 4, 2010).
20. Alaska v. Salazar, No. 3:10-cv-00205 (D. Alaska filed Sept. 9, 2010).
21. Margaret Cronin Fisk, *Alaska Claims in Suit U.S. Government Improperly Banned Off-Coast Drilling*, BLOOMBERG (Sept. 10, 2010).
22. Dan Joling, *Alaska Rips Feds Over Suspension of Arctic Drilling*, ANCHORAGE DAILY NEWS (Sept. 10, 2010).
23. Hall, *Oooguruk Project Offshore Alaska*.
24. Alan Bailey, *More Leases Dropped*, 15 PETROLEUM NEWS (Aug. 15, 2010), http://www.petroleumnews.com/pntruncate/109175427.shtml.
25. Letter from Sean Parnell, Governor of Alaska, to Michael Bromwich, Director, Bureau of Ocean Energy Management, Regulation, and Enforcement 5 (Aug. 25, 2010), *available at* http://gov.alaska.gov/parnell_media/documents/govltrtoBromwich.pdf.
26. Jim Efstathiou Jr., *BP's Liberty Oil Well in Alaska to Face New Safety Rules*, BLOOMBERG (June 24, 2010).
27. MMS, Draft Proposed Outer Continental Shelf (OCS) Oil and Gas Leasing Program 2010–2015 (January 2009) (on file with Commission staff) [hereinafter MMS 2009 Proposal].
28. Letter from Jane Lubchenco, Under Secretary of Commerce for Oceans and Atmosphere, to S. Elizabeth Birnbaum, Director, Minerals Management Service 5–12 (Sept. 21, 2009) [hereinafter NOAA 2009 Comments] (detailing NOAA's comments on the U.S. Department of the Interior/Minerals Management Service Draft Proposed Outer Continental Shelf Oil and Gas Leasing program for 2010–2015) (on file with Commission staff).
29. BOEMRE, Introduction_5-Year Program, http://www.boemre.gov/5-year/.
30. Kristen Nelson, *Chukchi High Five*, 13 PETROLEUM NEWS (Feb. 10, 2008), http://www.petroleumnews.com/pntruncate/347813743.shtml.
31. Native Village of Point Hope v. Salazar, 2010 WL 2943120 (D. Alaska July 21, 2010).
32. Yereth Rosen, *Shell, Statoil Get OK to Do Chukchi Oil Surveys*, REUTERS (Aug. 6, 2010).
33. Nelson, *Petroleum High Five.*
34. 43 U.S.C. §§ 1334(c), 1337(b)(2).
35. Shell Presentation to Commission Staff (Sept. 16, 2010).
36. NOAA 2009 Comments at 5.
37. This section is a general introduction to spill planning in Alaska and is not meant as a comprehensive evaluation of planning requirements.
38. 30 C.F.R. § 254.23.
39. 33 C.F.R. § 254.21 (requiring an emergency response plan with appendices); 33 C.F.R. § 254 .2 (setting out requirements for the worst-case discharge appendix).
40. 30 C.F.R. § 254.6.
41. ALASKA ADMIN. CODE 18 § 75.425(e)(1)(I).
42. The Alaska Oil and Gas Conservation Commission (AOGCC) was formerly a part of the Department of Natural Resources, but is now a quasi-judicial agency within the executive branch. *See* Letter from Parnell to Bromwich (urging BOEMRE to lift the moratorium on offshore drilling in Alaska waters).
43. The review team is made up of the AOGCC's petroleum engineer commissioner, a petroleum engineer; the chairman of the AOGCC, a geologist; and a public appointee with oil and gas experience. That Commission will also hold hearings after this Commission releases its report. "At this hearing, public testimony will be received and the Commission will examine relevant issues in light of the findings and conclusions of the National Commission." *See* Order by Daniel T. Seamount, Jr., Chair, Alaska Oil and Gas Conservation Commission, Notice of Inquiry by the State of Alaska (June 24, 2010), *available at* http://notes4.state.ak.us/pn/pubnotic.nsf/6132da015d9ca2fe89256785006af393/3269886a2a097ed18925774c007fa836?OpenDocument&Highlight=0,Order,by,Daniel,T,Seamount (indicating that a public hearing on the review will be noticed 30 days after this Commission issues its report).
44. *Id*.

45. Tim Bradner, *Alaska's Oil Regulators Work to Ensure the Industry Is Responsible*, ALASKA JOURNAL OF COMMERCE (July 16, 2010), http://www.alaskajournal.com/stories/071610/oil_ao.shtml.
46. Since the original release of this paper, Shell has announced that it will not seek to drill on its Chukchi Sea leases in 2011 and will instead seek to drill on its offshore leases in the Beaufort Sea. The response scenarios and plans included in the Chukchi C-Plan discussed here are largely applicable to plans for drilling in both seas.
47. The Macondo well was similarly in the exploratory drilling phase.
48. 30 C.F.R. § 254.26(d).
49. 30 C.F.R. § 254.47(b).
50. 0LASKA ADMIN. CODE 18 § 75.434.
51. SHELL, CHUKCHI SEA REGIONAL EXPLORATION OIL DISCHARGE PREVENTION AND CONTINGENCY PLAN (Mar. 2010), *available at* http://alaska.boemre.gov/fo/ODPCPs/2010_Chukch_cPlan.pdf [hereinafter SHELL C-PLAN].
52. *Id.* at 1–23.
53. *Id.* at 4–3.
54. *Id.*
55. *Id.*
56. Shell Presentation to Commission Staff (Sept. 16, 2010).
57. ALASKA CLEAN SEAS, www.alaskacleanseas.org.
58. SHELL C-PLAN at 1–22.
59. *Id.* at 1–26.
60. Letter from Jeffrey Walker, Regional Supervisor, Field Operations, MMS, to Susan Childs, Shell Offshore Inc. (Dec. 7, 2009), *available at* http://alaska.boemre.gov/ref/ProjectHistory/2009_Chukchi_Shell/2009_1207.pdf [hereinafter EP Letter] (conditionally approving Shell's 2010 exploration drilling program and noting that response to the contingency plan would follow separately).
61. 30 C.F.R. § 250.220.
62. EP Letter at 3.
63. Shell Presentation to Commission Staff (Sept. 16, 2010).
64. SHELL, CHUKCHI SEA REGIONAL EXPLORATION OIL DISCHARGE PREVENTION AND CONTINGENCY PLAN (May 2009), *available at* http://alaska.boemre.gov/ref/ProjectHistory/2009_Chukchi_Shell/2009_0623_Shell_cplan.pdf.
65. Letter from Jeffrey Walker, Field Operations, MMS, to Susan Childs, Shell Offshore Inc. (Dec. 18, 2009), *available at* http://alaska.boemre.gov/ref/ProjectHistory/2009_Chukchi_Shell/2009_1218_childs.pdf (conditionally approving the Shell C-Plan).
66. SHELL C-PLAN at 1–13.
67. SHELL C-PLAN.
68. Charles W. Schmidt, *Cold Hard Cache: The Arctic Drilling Controversy*, 118 ENVIRONMENTAL HEALTH PERSPECTIVES A394 (2010).
69. MAR, INC. ET AL., EMPIRICAL WEATHERING PROPERTIES OF OIL IN ICE AND SNOW PROJECT NUMBER 1435-01-04-RP-34501 FINAL REPORT FOR U.S. DEPARTMENT OF THE INTERIOR MINERALS MANAGEMENT SERVICE ALASKA OUTER CONTINENTAL SHELF REGION (Oct. 2008), *available at* http://alaska.boemre.gov/reports/2008rpts/2008_033/2008_033.pdf [hereinafter WEATHERING PROPERTIES].
70. Luc Rainville and Rebecca A. Woodgate, *Observations of Internal Wave Generation in the Seasonally Ice-Free Arctic*, 36 GEOPHYSICAL RESEARCH LETTERS L23604 (Dec. 2, 2009).
71. NUKA RESEARCH AND PLANNING GROUP, LLC, REPORT TO PRINCE WILLIAM SOUND REGIONAL CITIZENS' ADVISORY COUNCIL: RESPONSE GAP ESTIMATE FOR TWO OPERATING AREAS IN PRINCE WILLIAM SOUND, ALASKA (2007).
72. *Id.* at 41.
73. *Id.* at 52.

74. *See, e.g.*, *Response Gap*, OCEANS NORTH U.S., http://www.oceansnorth.org/response-gap (noting the potential value of a response gap analysis).
75. SHELL C-PLAN at 3–20.
76. WEATHERING PROPERTIES.
77. U.S. DEPARTMENT OF THE INTERIOR MINERALS MANAGEMENT SERVICE, ARCTIC OIL SPILL RESPONSE RESEARCH AND DEVELOPMENT PROGRAM: A DECADE OF ACHIEVEMENT (2009), *available at* http://www.boemre.gov/tarprojectcategories/PDFs/MMSArcticResearch.pdf [hereinafter ACHIEVEMENT].
78. *Id*. at 11.
79. *Id.*
80. DF DICKENS ASSOCIATES LTD., SINTEF, THE UNIVERSITY CENTRE AT SVALBARD, BOISE STATE UNIVERSITY, 2006 SVALBARD EXPERIMENTAL SPILL TO STUDY SPILL DETECTION AND OIL BEHAVIOR IN ICE: SUMMARY FIELD REPORT (Apr. 12, 2006), http://www.boemre.gov/tarprojects/569/SummaryFieldReport.pdf.
81. *Id*.
82. SHELL C-PLAN at 1–27.
83. *Id.* at 3–27.
84. *See* MINERALS MANAGEMENT SERVICE OFFICE OF PUBLIC AFFAIRS, QUESTIONS AND ANSWERS ON SHELL'S OCS CHUKCHI SEA EXPLORATION PLAN, *available at* http://www.boemre.gov/ooc/PDFs/CHUKCHI_SEA_QA1209.pdf; Press Release, Minerals Management Service, Salazar Conditionally Approves Shell's Exploration Plan for Certain Chukchi Sea Leases (Dec. 7, 2009), http://www.boemre.gov/ooc/press/2009/press1207.htm.
85. Of course, boom and skimmer technology can be of only limited use in spills in non-Arctic waters as well. The oil recovery from boom-and-skimmer efforts as part of the Deepwater Horizon response only constituted 3% of the total amount of oil recovered. NOAA, OIL BUDGET CALCULATOR TECHNICAL DOCUMENTATION (November 2010), *available at* http://www.restorethegulf.gov/sites/default/files/documents/pdf/OilBudgetCalc_Full_HQ-Print_111110.pdf.
86. ACHIEVEMENT at 15.
87. Hans V. Jensen & Joseph V. Mullin, *MORICE—New Technology for Mechanical Oil Recovery in Ice Infested Waters*, 47 MARINE POLLUTION BULLETIN 453 (2003).
88. Victoria Broje and Arturo A. Keller, *Improved Mechanical Oil Spill Recovery Using an Optimized Geometry for the Skimmer Surface*, 40 ENVIRONMENTAL SCIENCE & TECHNOLOGY 7914 (Oct. 26, 2006).
89. ACHIEVEMENT at 15.
90. SHELL C-PLAN at 3–27.
91. *Id.* at 3–26.
92. *See, e.g.*, WEATHERING PROPERTIES; PROGRESS REPORT, OIL IN ICE: TRANSPORT, FATE, AND POTENTIAL EXPOSURE (Progress Report for the Period Oct. 15, 2008 to Apr. 15, 2009), *available at* http://www.crrc.unh.edu/progress_reports/sintef/04_2009/index.htm.
93. WEATHERING PROPERTIES.
94. Amy Merten, NOAA Office of Response and Restoration, Coastal Response Research Center, "NOAA's Increased Preparedness for Arctic Response," Presentation at the National Ice Center Symposium (June 11, 2009).
95. SHELL C-PLAN at 1–27.
96. *Id.* at 1-27-1-28.
97. WORLD WILDLIFE FUND, NOT SO FAST: SOME PROGRESS IN SPILL RESPONSE BUT US STILL ILL-PREPARED FOR ARCTIC OFFSHORE DEVELOPMENT (2009) (reviewing and critiquing MMS's "Decade of Achievement" report).
98. DF DICKENS ASSOCIATES LTD., SINTEF, THE UNIVERSITY CENTRE AT SVALBARD, BOISE STATE UNIVERSITY, 2006 SVALBARD EXPERIMENTAL SPILL TO STUDY SPILL DETECTION AND OIL BEHAVIOR IN ICE: FINAL TECHNICAL REPORT (Dec. 15, 2006), http://www.boemre.gov/tarprojects/569/569AC.pdf.

99. SL ROSS ENVIRONMENTAL RESEARCH, D.F. DICKINS AND ASSOCIATES, VAUDREY AND ASSOCIATES, EVALUATION OF CLEANUP CAPABILITIES FOR LARGE BLOWOUT SPILLS IN THE ALASKAN BEAUFORT SEA DURING PERIODS OF BROKEN ICE (June 1998), *available at* http://www.boemre.gov/tarprojects/297/297AA.pdf.
100. SHELL C-PLAN at 3–24, 3–32 to 3–33.
101. *Id.* at 3–25.
102 ADAM MOLES, LARRY HOLLAND, AND JEFFREY SHORT, THE EFFECTIVENESS OF COREXIT 9527 AND 9500 IN DISPERSING FRESH, WEATHERED, AND EMULSION OF ALASKA NORTH SLOPE CRUDE OIL UNDER SUBARCTIC CONDITIONS (Apr. 2001), *available at* http://www.pwsrcac.org/docs/d0001400.pdf.
103. SL ROSS ENVIRONMENTAL RESEARCH, DISPERSANT EFFECTIVENESS TESTING IN COLD WATER (August 2002) *available at* http://www.boemre.gov/tarprojects/450/450mmsExCold.pdf.
104. *See, e.g.*, PRINCE WILLIAM SOUND OIL SPILL RESPONSE INSTITUTE, ADVANCING OIL SPILL RESPONSE IN ICE-COVERED WATERS 4 (2003), *available at* http://www.pws-osri.org/publications/OilIce_final.pdf (identifying research needs to improve response abilities in icy environments)
105 There is dispute within the scientific literature about whether dispersants promote biodegradation of oil. For more information, see the staff working paper on dispersants.
106. *See* WORLD WILDLIFE FUND, OIL SPILL RESPONSE CHALLENGES IN ARCTIC WATERS 7 (2007).
107. ALASKA REGIONAL RESPONSE TEAM, UNIFIED PLAN, ANNEX F: CHEMICAL COUNTERMEASURES F-11 (1999), *available at* http://www.akrrt.org/UnifiedPlan/F-Annex.pdf [hereinafter ANNEX F].
108. ALASKA REGIONAL RESPONSE TEAM, UNIFIED PLAN, NORTH SLOPE SUBAREA CONTINGENCY PLAN, RESPONSE SECTION, A-22 (2007), *available at* http://www.dec.state.ak.us/spar/perp/plans/scp_ns/ns_A-Response.pdf.
109. ANNEX F at F-2.
110. SHELL C-PLAN at 3–40.
111. *Id*. at 3–37.
112. *Id*. at 3–38.
113. *Id*. at 3–42.
114. Richard P.J. Swannell et al., *Field Evaluations of Marine Oil Spill Bioremediation*, 60 MICROBIOLOGICAL REVIEW 342, 342 (1996) (internal quotations omitted).
115. 40 C.F.R. § 300.5.
116. Swannell at 351–52.
117. *Id.* at 351.
118. *Id.*; *see also id.* at 358 ("[T]here is little convincing evidence to suggest that bioremediation is effective at sea. This is partly due to the logistical difficulties involved in conducting controlled open-sea trials. Further research is required to derive an effective bioremediation strategy at sea.") (internal citations omitted).
119. *Id.*
120. *Id.*
121 *Id.* at 352.
122. *See id.*; P.H. Pritchard et al., *Oil Spill Bioremediation: Experiences, Lessons and Results from the Exxon Valdez Oil Spill in Alaska*, 3 BIODEGRADATION 315 (1992).
123. Pritchard at 315.
124. SINTEF, Oil Biodegradation in Arctic Ice, http://www.sintef.no/Home/Materials-and-Chemistry/Marine-Environmental-Technology/Projects-and-News/Oil-biodegradation-in-Arctic-ice/. SINTEF is studying a number of techniques for combating oil spills in ice covered water. *See* SINTEF, JIP Oil in Ice, http://www.sintef.no/Projectweb/JIP-Oil-In-Ice/.

125. U.S. Patent No. 6,267,888 (issued July 31, 2001); U.S. Patent Application Publication No. US2010/0051541 A1.
126. 40 C.F.R. § 300 Subpart J.
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128. *See, e.g.*, Captain J.J. Fisher, "Policy & Cooperation in the Arctic," Presentation at Capitol Hill Ocean Week, (June 10, 2010), *available at* http://nmsfocean.org/CHOW-2010-agenda; "Oil Spill Response in the U.S. Arctic: A U.S. Coast Guard Perspective," Presentation at the Environmental Law Institute (Mar. 11, 2010), *available at* http://www.eli.org/program_areas/ocean_arctic_spill.cfm.
129. RONALD O'ROURKE, CONGRESSIONAL RESEARCH SERVICE, COAST GUARD POLAR ICEBREAKER MODERNIZATION: BACKGROUND, ISSUES, AND OPTIONS FOR CONGRESS 1 (July 2, 2010).
130. *Id.* at 3.
131. *Id.* at 4.
132. *Id.*
133. *Id.* at 10–11.
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144. *Id.*
145. *See* NATIONAL MARINE FISHERIES SERVICE, ENDANGERED SPECIES ACT_SECTION 7 CONSULTATION, BIOLOGICAL OPINION 13 (2002) (noting that, with reference to the construction and operation of the Liberty Oil production island in the Beaufort Sea, that bowhead whales will defect from their normal migratory paths at distances of up to 35 miles from seismic operations). Changes in migratory patterns will have a significant effect on Inupiat hunting: hunters must follow the whales into riskier waters, making the hunting trip longer and more dangerous. Further, the hunters may not be able to transport the carcass to the shore before it begins deteriorating, thus jeopardizing the whale's food potential.
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Chapter 25
Transatlantic Policy Options to Address the Rapidly Changing Arctic

Sandra Cavalieri and R. Andreas Kraemer

Abstract Impacts from rapidly occurring climate change in the Arctic region are creating shifts in economic priorities, especially in the energy, transport, fisheries and tourism sectors. Economic expansion combined with escalating environmental stress poses unique management challenges for these vulnerable socio-economic and ecological systems. This shifting economic landscape brings new challenges that threaten fragile Arctic ecosystems and the survival of indigenous communities and their way of life. Results from a multi-stakeholder transatlantic dialogue conducted through the *Transatlantic Policy Options for Supporting Adaptations in the Marine Arctic* (Arctic TRANSFORM) project in 2008–2009 reveal both sectoral and cross-sectoral regulatory gaps and present a set of policy options. Progress to ensure environmental security in the Arctic depends on the development of resilient, adaptable, and coherent governance regimes capable of protecting terrestrial, freshwater and marine ecosystems. However, the current governance framework is more a patchwork of legal instruments, ranging from soft-law arrangements to bilateral and multilateral agreements, supra-national, national and sub-national arrangements. In addition, most of these instruments and related institutions focus on global issues, rather than specifically targeting the Arctic. Thus, there is need for coordination in an integrated governance and regulatory system both among Arctic states and at the international level to manage the Arctic region.

S. Cavalieri (✉) • R.A. Kraemer
Ecologic Institute, Pfalzburger Straße 43/44, 10717 Berlin, Germany
e-mail: sandra.cavalieri@ecologic.eu

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25.1 Introduction

Arctic sea ice is melting faster [22] than the worst case scenario presented in the global climate assessment published by the Intergovernmental Panel on Climate Change [18]. In September 2007, summer Arctic sea ice retreated to the smallest extent since satellite records began in 1979. In December 2010, winter sea ice extent was the lowest on record for all previous December months, with a linear rate of decline of −3.5 % per decade [20]. Thawing permafrost is more difficult to observe, but there is a general increase in permafrost temperatures in Alaska, Siberia and Northern Europe, with significant warming in Arctic coastal areas during the past 5 years (Romanovsky 2010). The consequences of rapid change in Arctic marine and terrestrial systems for global biogeochemical cycles are uncertain. Loss of sea ice may expand economic opportunities in the energy, transport, fisheries and tourism sectors. Increased economic activity coupled with escalating impacts of climate change, pollution and other related environmental stressors poses challenges for already vulnerable local residents and ecological systems.

In light of the rapid environmental state-change occurring in the Arctic, there is a need to develop an integrated regulatory framework to ensure sustainable development of the region's natural resources. This framework should rely in part on development of stringent environmental and sustainability standards prior to resource development. Until recently, natural resources had limited accessibility due to year-round sea ice. However, it now seems likely that these resources will become more accessible in the near future. Furthermore, the Arctic environment is relatively pristine compared to other places on the earth, despite disproportionate levels of transboundary pollutants. There is, therefore, both a need and an opportunity for the Arctic to be a model for integrated ecosystem based management. Although there is widespread international agreement among scientists and policy makers that the Arctic is threatened, it is unclear how to implement a more integrated approach because decision-making has historically been focused either solely within Arctic states or within sectors.

25.2 Arctic TRANSFORM

The European Union (EU) formally recognised the need for an integrated policy approach to the Arctic Ocean in its *Integrated Maritime Policy* adopted in 2007 [10]. As part of this effort, the EU funded an 18-month dialogue called Arctic TRANSFORM, which brought together experts from the United States (US) and EU to develop policy options to support adaptation in the marine Arctic. Approximately 50 experts formed working groups according to five sectoral areas, including: environmental governance, indigenous peoples, offshore hydrocarbon, fisheries, and shipping. Experts were encouraged to develop both sector-specific and cross-sectoral solutions. Although the dialogue focused on the Arctic marine area, resulting policy options are relevant for the entire Arctic region. Also, despite the focus on EU-US transatlantic relations, experts recognised the need to expand the dialogue to all

Arctic states, and effort was made to include additional participants, especially from Russia and Canada.

This paper presents the results of the Arctic TRANSFORM dialogue [6]. It begins with an overview of the Arctic policy context with specific attention to EU and US Arctic policy developments. Each Arctic TRANSFORM working group issue area is summarised with a focus on critical policy gaps within and across each area. Finally, opportunities for transatlantic cooperation are presented that address these gaps and the overarching need for enhanced integration in Arctic environmental governance.

25.3 Current Policy Context

The world took notice of changing Arctic geopolitics when Russian Parliamentarian Arthur Chilingarov planted the Russian flag on the seabed underneath the North Pole in August 2007, just 1 month prior to the lowest sea ice extent in recorded history. The incident sparked renewed debate on Russia's intention, and provides a frequent touchstone for discussions on security in the Arctic region. Since then, Canada, Finland, Russia, the US as well as the EU have released new and revised Arctic policies. In addition, in 2009, a number of non-Arctic states, including the European Commission, China, Italy and South Korea applied for Permanent Observer status to the Arctic Council, the inter-governmental forum of the eight Arctic states and six indigenous peoples'organizations focused on sustainable development and environmental governance in the Arctic. All applications were deferred to the May 2011 Ministerial Meeting, when it was determined that observer status decision would be postponed until at least the next Ministerial Meeting. Although it remains to be seen when the European Commission will be invited to join the Arctic Council as a Permanent Observer, they have since developed the most comprehensive policy statement among the non-Arctic state actors.

25.3.1 Current EU and US Arctic policy

In March 2008, the European Commission and the High Representative released the *"Climate Change and International Security"* report [15], which referred to the Russian flag incident and stated: "the increased accessibility of the enormous hydrocarbon resources in the Arctic region is changing the geo-strategic dynamics of the region with potential consequences for international stability and European security interests." The subsequent Communication, *"The European Union and the Arctic Region"* [11], represents the first layer of an Arctic policy for the EU and intends to "open new cooperation perspectives with the Arctic states." The Communication's three main objectives are: (1) protect and preserve the Arctic in unison with its population; (2) promote sustainable use of resources; and (3) contribute to enhanced

Arctic multilateral governance. In 2009, the EU Council adopted *"Council conclusions on Arctic issues"* [13], emphasising the need for:

> Maintaining the Arctic as an area of peace and stability and highlighting the need for responsible, sustainable and cautious action in view of new possibilities for transport, natural resource extraction and other entrepreneurial activities linked to melting sea ice and other climate change effects.

The European Parliament further adopted a resolution on *"A Sustainable EU Policy for the High North,"* recommending ways that the EU could increase its presence in Arctic affairs [14].

While the EU is a relative newcomer to Arctic policy, the US has played a key role since its purchase of the Alaskan territory in 1867. The area served a strategic role in US security policy during the Cold War period and has long been of key interest for its abundant natural resources. Alaska became a state in 1959, and as interests in the region have evolved, climate change, security concerns, and natural resource interests are among the key drivers behind the need to adapt US policy. In 2009, the Bush Administration updated the US Arctic policy by issuing its Presidential Directive on the Arctic region [26], which acknowledges the need to reform the current international Arctic governance regime and indicates a willingness to consider new or enhanced international agreements to address expected changes in the region. The policy was developed through an inter-agency working group and is seen as non-partisan. It focuses on similar issues to the Communication adopted by the European Commission [11]: environmental protection, sustainable development of natural resources, international cooperation, inclusion of indigenous peoples and scientific research, with the notable addition of US security interests.

A comparison of the EU and US Arctic policies shows strong agreement: both affirm their commitment to the existing law of the sea framework and desire to work within existing institutions and frameworks, although both indicate a willingness to improve and modify some of these frameworks to address specific Arctic conditions. The policies also highlight the importance of including indigenous people in Arctic decision-making, especially because their communities are threatened by rapid environmental change and could be negatively impacted by unregulated economic expansion. Both policies emphasise their commitment to scientific research and monitoring, and call for enhanced coordination for safety and emergency response.

As highlighted by the recent EU and US policy statements, the current governance framework should be modified to address the changing Arctic conditions. It is of critical importance to note that no governing body has a mandate to develop legally binding rules for the entire Arctic region. The Arctic Council serves only as a monitoring body and provides a forum for discussing sustainable development and environmental protection. The *United Nations Convention on the Law of the Sea* [23] provides a general governance framework, but relies on global and regional sectoral institutions to implement its provisions. In addition to the lack of an integrated governance framework, there are policy gaps within sectors that are important to address, as discussed in the following sections.

25.4 Environmental Governance

The Arctic supports a broad range of unique habitats that support globally significant populations of flora and fauna, including more than half of the world's shorebird species. Arctic boreal forest and ocean ecosystems are critical to regulating the global climate and biogeochemical cycling. The 2010 Arctic biodiversity assessment from the Arctic Council's Conservation of Arctic Flora and Fauna working group [8] further finds that many of these ecosystems, including sea ice, tundra, thermokarst ponds and lakes, and permafrost peatlands have started to disappear over recent decades. These systems are threatened by impacts from global change and regional impacts from habitat disturbance and harvesting. The fundamental challenge of environmental governance is to build resilient and adaptable governance regimes capable of protecting fragile Arctic ecosystems. Cross-sectoral governance strategies, which take into account both natural systems and human activities in a holistic and integrated manner, should be the aim of regional and global policies.

25.4.1 Transatlantic Policy Options for Improving Environmental Governance

The recent EU and the US Arctic policy statements [11, 26, 27] point to agreement that Arctic governance should be informed by the principles of ecosystem-based management. The European Commission [11] Communication states that *"holistic, ecosystem-based management of human activities"* should complement any efforts to mitigate and adapt to the changes in the Arctic caused by climate change. Similarly, the US Presidential Directive [26, 27] states that the relevant executive agencies should *"pursue marine ecosystem-based management in the Arctic."*

Both the EU and the US are implementing ecosystem-based management in their Exclusive Economic Zones (EEZs), and could work together to promote a broader application of transboundary and cross-sectoral Arctic governance. They could also work bilaterally on an Arctic Ocean Assessment, identifying important marine areas in need of protection. While terrestrial protected areas have increased, there is an urgent need to identify and protect biologically important marine areas. Continued co-operation in regulatory bodies, such as the International Maritime Organization (IMO) and in international fisheries negotiations, is also critical to achieving environmental goals.

25.5 Indigenous Peoples

Four million people live in the Arctic, including more than 30 distinct indigenous peoples that speak dozens of languages across Alaska, northern Canada, Greenland, Norway, Finland, Sweden and Russia [1]. It is important to bear in mind the diversity among Arctic people and Arctic nations – although the Arctic is often thought of as a uniform region, there is a vast array of local and regional contexts. In addition, it is critical that indigenous peoples be recognised as 'rights holders' rather than 'stakeholders' to ensure their interests are not marginalised as governance structures are modified and developed. Arctic indigenous peoples have survived over millennia by depending on marine, freshwater and land-based living resources. Traditional Ecological Knowledge, which is rooted in geographic place and informed by historical decisions, is now threatened along with the language and culture of many of these groups. The environmental state-change in the Arctic has a direct impact on the socio-economic structure of Arctic communities. Traditional livelihoods are threatened as impacts from climate change disrupt hunting and fishing – especially since polar bears, seals, whales and some fish species depend on sea ice. Thawing permafrost has potentially widespread implications for community infrastructure. In short, indigenous peoples now face multiple stressors that range from climate change to globalisation; many of these threats also extend to the non-indigenous local population.

25.5.1 Transatlantic Policy Options Relating to Indigenous Peoples

The EU and US policy statements [11, 26, 27] clearly recognise the important role of indigenous peoples in Arctic decision-making. Across the Arctic, indigenous peoples have varying degrees of autonomy – the Kalaallit and Inughuit of Greenland, Inuit of Nunavut, and Sami in Fennoscandia have a greater degree of sovereignty than others – but all are still in some way dependent on Arctic states to sustain their economies. The Arctic Council is a key forum that affords indigenous groups special status as Permanent Participants.

There are multiple ways indigenous peoples can be supported to face the rapidly occurring change in the Arctic region. Opportunities for transatlantic cooperation should focus on maintaining indigenous peoples' high-level status in the Arctic Council or any other future forum or mechanism. The EU and US could also support development of an Indigenous Rights Review Working Group to assess legal and institutional barriers to adaptation. Funding is needed to ensure participation and develop indigenous capacity. New knowledge developed through Arctic Council assessment and other government-funded research should be disseminated to indigenous peoples through appropriate channels. A portion of the proceeds from commercial development could establish a fund to support indigenous communities to help strengthen their voice and implement adaptation measures.

Adaptation is of key concern for the local and indigenous peoples. A vulnerability and adaptation assessment, originally proposed by the Arctic Council's Vulnerability and Adaptation to Climate Change in the Arctic (VACCA) project, could help identify critical needs and set priorities to adapt to changes caused by increased coastal erosion and melting sea ice, infrastructure damage from thawing permafrost, and increased industrialisation of the region. Assessments should be community-based, with a high level of involvement from indigenous peoples to develop new regimes for marine and land-based natural resource exploitation.

25.6 Fisheries Management

Warmer regions of the Arctic marine area, especially the Barents Sea and to the east and south of the Norwegian Sea, have supported commercial fishing for decades, but until recently, colder, ice-covered waters have been inaccessible to fishing vessels. As sea ice retreats, new parts of the Arctic Ocean are expected to become accessible and warmer ocean waters may support a northward migration of certain fish species. Pelagic fisheries in the high seas may also be altered due to changes in feeding migration. A key gap in fisheries management is the lack of agreements designed to handle moving fish stocks. In addition, a significant part of the marine Arctic is not covered by a Regional Fisheries Management Organization (RFMO) or similar agreement other than for tuna, tuna-like species and anadromous species [19]. At the same time, there is a general lack of baseline data for Arctic fisheries, especially in the Arctic Ocean, where until very recently year-round ice cover hindered the monitoring of fish stocks.

25.6.1 Transatlantic Policy Options for Fisheries Management

In 2008, the United States [25] approved a public law to take necessary steps with other Nations to negotiate an agreement for managing migratory and transboundary fish stocks in the Arctic Ocean, following from the United Nations [24] agreement to manage migratory and transboundary fish stocks. This Senate Joint Resolution calls on the US to support the halt of commercial fisheries in the Arctic Ocean high seas until an agreement is reached. In 2009, the Obama administration followed the recommendation of the North Pacific Fishery Management Council's Arctic Fishery Management Plan and banned most commercial fisheries off the Alaskan coast north of the Bering Strait until more data is collected on the impacts of climate change on Arctic fisheries [26, 27]. Although the EU does not include any Arctic coastline, the European Commission [11] communication echoed the United States [25] Senate Joint Resolution in calling for a moratorium on Arctic high seas fisheries.

There is an opportunity to coordinate efforts in international fora, such as the United Nations and International Council for the Exploration of the Sea and through various RFMOs to prepare for commercial Arctic fisheries. An integrated approach to fisheries management could move beyond traditional activities to include regulation with other Arctic activities (i.e., shipping, offshore hydrocarbon development and creation of marine protected areas). The Arctic TRANSFORM Fisheries Working Group also proposed that the EU and US organise a high-level Arctic fisheries conference that could agree on a declaration for future Arctic fisheries (Box 25.1).

Box 25.1 Potential Declaration for Future Arctic Fisheries

- *"Acknowledge the potential expansion of commercial fisheries in the Arctic;*
- *Acknowledge the subsistence needs of indigenous communities that are traditionally dependent on marine living resources;*
- *Make a commitment to undertake or enhance cooperative research efforts to assess the likely expansion of such fisheries in the Arctic and the potential effects of such fisheries on marine ecosystems and indigenous communities;*
- *Recall that there already exists a body of general norms and standards pertaining to international fisheries arising from international agreements and other instruments, including relevant UNGA resolutions;*
- *Affirm that those norms and standards apply in the Arctic as they do elsewhere;*
- *Declare that they will not conduct new commercial fisheries or expand existing commercial fisheries in the Arctic until they have undertaken adequate assessments of the potential impacts of such fisheries on target and non-target species, on the marine ecosystem(s) as a whole, on the subsistence needs of indigenous communities and have developed conservation and management measures to ensure that such fisheries are sustainable; and*
- *Consider the development of new multilateral mechanisms for conserving and managing future Arctic fisheries, including a possible Arctic Regional Fisheries Management Organization (or organizations)* [5]."

25.7 Offshore Hydrocarbon Activities

Energy production and consumption is a central concern to both the US and EU. A recent United States Geological Survey study estimates that there are 90 billion barrels of oil, 1,669 trillion cubic feet of natural gas, and 44 billion barrels of natural gas undiscovered in the Arctic, with approximately 84 % of these located offshore [7]. At the same time, there are no comprehensive mandatory regulations for prevention, reduction and control of pollution caused by offshore hydrocarbon activities, which would be compounded by cold Arctic conditions. The Arctic Council's *Offshore Oil and Gas Guidelines* [3] provide a useful starting point; however, they are voluntary and may need to be strengthened since they were developed by consensus. Furthermore, emergency response infrastructure is needed to quickly respond to accidents to protect the environment and ensure human safety.

25.7.1 Transatlantic Policy Options for Oil and Gas Extraction

The USGS estimates that the approximately 30 % of the total Arctic reserves could be off the coast of Alaska [7]. Therefore, the US and EU have fundamentally different situations as relates to Arctic offshore resources because the EU does not have an Arctic coastline. While the US has direct control over these resources, since the EU currently consumes approximately 24 % of the total Arctic oil and gas output, it has considerable market influence that could be used to promote sustainable development of the region's resources [9].

Since BP's *'Deepwater Horizon'* oil spill in April 2010 in the Gulf of Mexico, offshore hydrocarbon exploitation has been in the political spotlight. In March 2010, the Obama administration proposed the opening of an extensive amount of US coastal area to offshore drilling, but this decision was rescinded in December 2010 until stronger safety and environmental standards are in place. This decision allows Shell's Arctic lease to remain in effect, but additional environmental reviews and spill response measures must be implemented prior to drilling. The US Department of Interior will study potential Arctic drilling sites before leases are decided for 2012–2017 [28].

The European Commission [11] Communication notes that the Arctic Offshore Oil and Gas Guidelines from the Arctic Council [3] could be endorsed, but does not provide specific details. More recently, in 2010, the EU adopted its *Communication on the Safety of Offshore Oil and Gas Activities*, calling for collaboration with Arctic countries to develop *"binding international rules or benchmarks … building inter alia on the guidelines of the Arctic Council"* [12].

The most promising opportunity for promoting transatlantic cooperation in Arctic offshore energy development is in strengthening environmental impact assessments (EIAs) and promoting best practices generally within and between EEZs. Several EU Member States exploit offshore resources and could engage in a cooperative effort that includes and extends beyond the Arctic. These efforts could set the foundation for a mandatory pan-Arctic EIA.

25.8 Shipping

Globalisation and climate change were identified in the Arctic Council's Arctic Marine Shipping Assessment [2] as key drivers of increased Arctic shipping. In particular, regional shipping is rapidly increasing due to increased hydrocarbon and mineral extraction. In 2004 there were approximately 6,000 shipping vessels in the Arctic, of which 1,600 were fishing vessels. There is also a marked increase in tourist cruise ships, which often operate in uncharted waters and require limited training and regulations for operators. Trans-Arctic shipping could become viable in summer months, and would reduce transport distances between Europe and East Asia by 40 %. These sharp increases in Arctic shipping require changes to emergency and pollution response procedures to minimize potential impacts. There are policy gaps in environmental regulations for ships, including lack of discharge, emission and ballast water exchange standards in Arctic waters that should be addressed. There is also a lack of agreement on planning and preparedness for pollution incidents for the entire Arctic marine area. The International Maritime Organization (IMO) is developing guidelines to address some of these issues in the *"Ships Operating in Arctic Ice-Covered Waters"* (known as the 'Polar Code;' [16]) that are expected to become mandatory with applications to both polar regions [17]. Complementing these activities, in 2011, at the Seventh Ministerial Meeting of the Arctic Council, a pan-Arctic search and rescue agreement [4] was signed by the eight Arctic states.

25.8.1 Transatlantic Policy Options for Maritime Transport

The EU and US share an interest in protecting the Arctic marine environment, and could strengthen cooperation to improve shipping regulations, in particular by working together in the IMO to ensure that the Polar Code [16, 17] becomes mandatory. They could also work together to develop maritime infrastructure, and NASA and ESA could cooperate to share information on maritime surveillance of Arctic traffic. In addition, they could jointly propose, along with other Arctic coastal states, the designation of all or part of the Arctic Ocean as a Particularly Sensitive Sea Area (PSSA), which would provide additional protection through stringent emission, discharge and ballast standards as well as through navigational routing systems with compulsory reporting for ships.

25.9 Conclusion

The Arctic is undergoing an environmental state-change that requires an international response. Both Arctic and non-Arctic states are paying increasing attention to potential new economic opportunities that will arise due to increased accessibility to the Arctic Ocean. Equal attention should be focused on sustainable development of these resources. Arctic states seem to support strengthening the Arctic Council – without losing the prominent role of indigenous peoples – but are unsure of how to develop an integrated governance system that ensures sustainable development of the Arctic's living and natural resources. As discussed in this chapter, a summary of the critical policy gaps to help guide next steps in addressing these shortcomings is presented in Table 25.1.

The Arctic environment is impacted by activities that take place both within and outside of the Arctic region. Its forest and marine systems have implications for global climate cycles. There is an opportunity for the EU and US to improve internal policies to reduce their respective ecological footprints in the Arctic, as well as strengthen cooperation to ensure that Arctic resources are developed sustainably, in part to benefit local and indigenous peoples.

Table 25.1 Overview of the critical policy gaps according to sector in the Arctic region

Sector	Policy gap
Environmental governance	Lack of governance regime capable of protecting fragile Arctic ecosystems
Indigenous peoples	Lack of adequate political representation and little focus on strengthening the socio-economic structure of Arctic communities
Fisheries management	Lack of an integrated approach to fisheries management that includes regulation with other activities, namely: shipping, offshore hydrocarbon activities and designation of marine protected areas
Offshore hydrocarbon activities	Lack of comprehensive mandatory regulations for prevention, reduction and control of pollution for offshore hydrocarbon activities in Arctic waters
Shipping	Lack of environmental regulations for ships (especially discharge, emission and ballast water exchange standards) and lack of agreement on planning and preparedness for pollution incidents in the Arctic region

In May 2011 the Arctic Council again postponed decisions about observer status for the European Commission, China, Italy and South Korea. Even if they are denied, it is clear that non-Arctic states will be active users of the Arctic. If interested parties are denied a seat at the table, opportunities to strengthen cooperation and develop early coordination of Arctic natural resource protection and development could be missed.

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Part VI
Promoting Cooperation and Preventing Conflict in the Arctic Ocean

Chapter 26
Political Stability and Multi-level Governance in the Arctic

Olav Schram Stokke

Abstract This chapter examines the interplay between regional institutions for governing the Arctic and broader institutions applicable there and elsewhere. Despite rapid environmental change in the Arctic, political stability remains high. One reason is that Arctic states have relatively few unsettled maritime boundary issues and manage the remaining ones in a cooperative manner. Another reason is that an international legal framework exists for governing economic use of the region. The framework is based on global, customary international law codified in the *United Nations Convention on the Law of the Sea* (UNCLOS, http://www.un.org/Depts/los/convention_agreements/texts/unclos/closindx.htm.) and obliges states to respond individually and jointly to the new challenges deriving from increasing economic activities. The chapter then examines the adequacy of regional means for strengthening the Arctic governance system, and finds that regional institutions like the Arctic Council have only partial roles to play – the Arctic Ocean needs multi-level governance. The fact that Arctic environmental challenges cannot be addressed without significant contributions from broader or global institutions raises the question of how the Arctic Council should deal with certain non-Arctic states wishing to participate in Council work. Important governance functions like generating knowledge on environmental risks and response options, obtaining Arctic-sensitive regulations in broader international fora, and mobilizing resources and legal competence to support rule implementation stand to benefit from greater involvement of other interested states. Providing effective and legitimate governance is the best basis for ensuring political stability in the Arctic.

O.S. Stokke (✉)
Research Professor, Fridtjof Nansen Institute, Fridtjof Nansens vei 17,
Lysaker 1366, Norway
e-mail: olav.s.stokke@fni.no

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26.1 Introduction

Is the present institutional framework for Arctic governance adequate for avoiding conflict over resource use and other economic activities? What is the appropriate division of labour between regional and global components of this framework? And how can a regional institution like the Arctic Council maximize its contribution to effective and legitimate governance in the Arctic? I argue in this chapter that conditions for adaptive and peaceful management of activities in this region are favourable because a dynamic governance framework is already in place and inter-state jurisdictional rivalry is modest. Globally applicable regimes like those based on the Law of the Sea Convention weigh the most in Arctic governance, but regional institutions too can play important roles in strengthening substantive regulations, mostly by influencing other institutions.

My contention that the overall governance framework in the Arctic is strong and dynamic contrasts with recent reports of an 'ongoing race for natural resources' [22] with Arctic states allegedly engaging in 'unilateral grabs' and approaching a 'diplomatic gridlock' [13]. That is why the next section substantiates the political stability inherent in the firm jurisdictional bases that exist for adopting and enforcing binding regulation of regional economic activities, the advanced state of affairs regarding delimitation of Arctic maritime zones, and the firm articulation of cooperation in the Arctic policy documents that major states have published in recent years. My proposition that circumpolar institutions derive their regulatory potential primarily from their ability to affect other institutions is contrary to recent claims by some scholars (e.g. [17, 31]), practitioners [22], and civil-society organizations that a new and legally binding convention for protecting the Arctic environment is badly needed. The subsequent section therefore shows why the eight member states of the Arctic Council are either too few or too many to deal effectively with the management challenges associated with greater commercial interest in the Arctic. Contrary to recent scepticism among certain veto players in the Arctic Council regarding greater involvement of non-Arctic states [25, 40], the third substantive section argues that the ability of this institution to strengthen the overall regional governance system will actually benefit from such broader involvement. The final section summarizes the argument and draws some political implications for Arctic Ocean governance.

26.2 Environmental Change, Political Stability

The simplistic connections sometimes implied between melting ice and more accessible resources, and between rising economic activities and political instability, do not stand up to closer scrutiny. Also associated with a warmer Arctic are harsher weather conditions, greater density of moving ice, and thawing permafrost, all rendering Arctic operations more difficult and costly. Increases in commercial use of Arctic resources and sea routes will occur gradually. The allocation among states of competence to regulate those activities is clear-cut and firmly based in international law, with unsettled boundaries managed cooperatively and Arctic states emphasizing their commitments to legal rules clearly compatible with their self-interest. This section elaborates on these various stabilizers of Arctic politics.

Global warming is affecting the Arctic with particular force and with rebound effects further south. Temperature rises of more than twice the global average are influencing the heat exchange between land, air and water. Recent atmospheric studies indicate a new connectivity between changing Arctic wind patterns and colder, more snowy weather in southern locations [37]. Multi-year ice is diminishing at alarming speed; the 2010 sea ice minimum was the third lowest in three decades and the last four summer minima were the lowest in satellite history [39]. A distinctly Arctic feedback mechanism amplifies these developments, since receding snow and ice expose darker ocean surface, thereby enhancing heat absorption and accelerating further melting. Contributing to the Arctic amplification is also the weakening of the ocean-circulation regime known as the Beaufort Gyre, which results in cold water increasingly flowing out of the Arctic into adjacent seas. The calving in summer 2010 of a 290 km^2 segment of the Petermann Glacier in Northwest Greenland alone amounted to nearly three times the average annual area loss of marine-terminating glaciers during the 2000s [14]. Within a few decades, considerably sooner than predicted in the recent Arctic Climate Impact Assessment [3], these various processes are likely to transform the Arctic Ocean from an ice-covered sea to a seasonally open sea, for the first time in 13–14 million years [46]. Particularly threatened by these developments are ice-dependent species like ice algae, marine mammals and certain sea birds [35]. Changes in water temperatures and salinity will also affect the migratory patterns of boreal fish stocks. On land, significant movement of the permafrost boundary and of treelines is already underway, implying a gradual displacement of Arctic deserts by tundra, and of tundra by forests, with corresponding changes in the spatial distribution and diversity of species [3]. In the American High Arctic, increases in greening of up to 15% have been observed since the early 1980s [58]. These rapid and interconnected changes explain why the Arctic is sometimes called a global *"weather kitchen"* and will increasingly influence the occurrence of marine and terrestrial living resources and the physical conditions for navigation within the region.

The relationships between these environmental changes and the accessibility of natural resources and maritime transport routes in the Arctic are not straightforward, however. While less sea ice will improve access to some onshore and offshore areas, other impacts – such as higher mobility of sea ice, more frequent calving, wilder weather and greater coastal erosion – are expected to create new operational challenges and risks for Arctic offshore transport and petroleum operations [6]. Thawing permafrost already undermines onshore infrastructures for Arctic resource exploitation, including roads, buildings, and pipelines. Similarly, as the Arctic Marine Shipping Assessment [8] points out, it is only the multi-year ice that is expected to disappear, meaning that navigation through the Northeast and the Northwest Passages will continue throughout this century to struggle with sea ice except for a few months during summer. This continuity has significant impacts on the commercial viability of trans-Arctic shipping as compared to the longer routes through the Suez or Panama canals, because navigation in ice requires purpose-built vessels, greater energy use, higher insurance costs and costly ice-breaker escort [16]. As regards living resources, higher temperatures will increase the primary production of plankton, but growth conditions may deteriorate due to wild-weather induced light impairment. In the European segment of the Arctic, the copepod *calanus finmarchicus* is a crucial hub in the food web that links primary production to commercial species like capelin and cod, and researchers fear that higher temperatures will favour less nutritious copepods currently found further south [35]. Despite rapid environmental changes, therefore, continuity marks many of the factors that constrain trans-Arctic shipping, while the climate effects on the economics of living and mineral resource use in the Arctic are ambiguous. This means that states and other actors have adequate time to adapt and improve the governance systems surrounding regional commercial activities without jeopardizing the high political stability that marks this region.

One important stabilizer of Arctic politics is the UNCLOS, globally applicable and differentiating the competence to regulate ocean use by activity and distance from the coast. This treaty has 162 parties (as of August 2011) and, although the United States has yet to ratify, major provisions codify international customary law and are binding on all states. It reflects a political balance struck between coastal-state demands for control over natural resources, and maritime-state requests for unrestricted navigation [49]. The coastal state has sovereignty over the territorial sea, which may extend 12 nautical miles from the baselines, but cannot deny foreign-vessel passage that is 'innocent' (i.e., not involving certain specified activities like threats of force, deliberate pollution, and the like). The coastal state's regulatory leeway is even narrower in straits used for international navigation and in the exclusive economic zone (EEZ). An EEZ may extend to 200 nautical miles and entails sovereign rights to regulate and exploit natural resources in the water masses, seabed and subsoil. For seabed and subsoil resources like nodules, oil and gas, those rights extend even further throughout the natural prolongation of the coastal state's land territory (i.e., the 'continental shelf'), within certain overall limits. Finally, on the high seas beyond the EEZs, the flag state retains its near-monopoly on regulation of vessel operations but must cooperate with other states on the management of marine living resources. For all the activities expected to increase in the Arctic, therefore, the UNCLOS allocates regulatory competence in undisputed ways. Arctic states, including the United States and Russia, were leading proponents of the jurisdictional differentiation that emerged in the UNCLOS, and changing it would certainly not be in their interest.

The political stability inherent in a clear jurisdictional allocation is supported by the political determination among Arctic states to deal with potentially contentious issues cooperatively and peacefully [e.g. 23]. Perhaps the clearest evidence of such determination is the way they have dealt with the maritime boundary delimitations that became necessary when coastal states obtained extended jurisdiction over their continental shelves and EEZs. A large proportion of these international boundaries have now been settled, and the remainder are managed cooperatively. Norway's eastern continental shelf and EEZ boundary towards Russia in the Barents Sea was agreed in 2010 [12]. Its western boundary towards Denmark/Greenland was settled by three agreements adopted from 1995 to 2006, one of them following agreed submission to the International Court of Justice and thereby demonstrating the strong commitment of both states to international law, including its procedures for peaceful dispute settlement. Denmark/Greenland's western continental shelf boundary towards Canada up to the Nares Strait was agreed already in 1973 [24] (Greenland-Canada Continental Shelf Agreement 1974). A treaty drawing up Russia's eastern boundary towards the United States was adopted in 1990 and, although it is not yet in force has been applied provisionally pending ratification by the Russian Duma. Canada has yet to settle its western boundary towards the USA in the Beaufort Sea and its northeastern boundary towards Denmark/Greenland in the Lincoln Sea, and Russia, Denmark/Greenland, and Canada may have overlapping Central Arctic Ocean continental shelf claims associated with the Lomonosov Ridge, so the overall boundary settlement rate in the Arctic is around 0.5. Underlying this figure is the rough assertion that the US–Russian boundary (adopted, not ratified by Russia) and the Canada–Denmark/Greenland boundary (agreed up to 82° N) are half-settled, whereas the Canada–US and the (possible) Canada–Denmark/Greenland–Russia boundaries are unsettled. The figure compares favourably with its global counterpart, which according to a recent count is less than 0.4 [42]. The Arctic boundary settlement rate is all the more impressive when we consider that the presence of ice has so far severely restricted the scope of marine activities in most of the region, thus reducing the practical use of delimitation [18]. Moreover, all Arctic coastal states have either submitted or are preparing geological and bathymetrical documentation of claims to the Commission on the Limits of the Continental Shelf, in accordance with Article 76 of UNCLOS. When Russia's 2001 submission regarding its Central Arctic Ocean claim was found inadequate by the Commission [56], Russia duly proceeded to prepare a revised submission. No less important is the longstanding inclination of Arctic states to cooperate on resource management issues also when boundaries are not finalized. During 35 of the 40 years it took to negotiate the Barents Sea boundary, Norway and Russia operated and gradually deepened one of the most successful international shared-stock management regimes covering, *inter alia,* the world's biggest cod stock [50]. Already in 1977, Canada and the USA developed a joint marine contingency plan in the contended Beaufort Sea and have revised it regularly [32]. Both the rate of Arctic boundary settlement and the manner in which Arctic states manage non-settled boundaries indicates a firm determination to deal cooperatively with contested issues.

Political determination to maintain regional stability also marks the Arctic policy documents that Arctic states have prepared in recent years. The United States *Arctic Region Policy* strongly recommends the Senate to ratify the Law of the Sea Convention and emphasizes multilateral institutions and collaboration with other states in such key areas as environmental protection, safety at sea and the improvement of maritime infrastructure [57]. International cooperation is prominent also in Arctic strategy of the Russian Federation [43] with its emphasis on how agreements and coordination with other states can help ensure that regional natural resources under national jurisdiction and greater use of the Northern Sea Route will benefit Russian society. According to this policy document, preserving the Arctic as a zone of peace and cooperation is among Russia's main interests in the Arctic, operationalized as guaranteeing mutually beneficial bilateral and multilateral cooperation between the Russian Federation and other Arctic states on the basis of international treaties [30]. No less firm in its commitment to international rules and collaborative frameworks is Norway, whose recent High North strategy pledges to base 'management of living marine resources … on the rights and duties set out in the Law of the Sea', to 'further develop people-to-people cooperation' and to 'strengthen our cooperation with Russia' [33]. Whether large or small, therefore, the regional states have recently developed Arctic policy documents compatible with their highly cooperative body language regarding potentially conflictive issues like maritime boundary delimitation and transboundary resource management.

In sum, the rapid environmental changes underway in the Arctic cannot be said to pose severe threats to the political stability of this region. Shifts in resource accessibility are slow and ambiguous, allowing adequate time to devise appropriate responses. The ways in which the Arctic states deal with jurisdictional issues, including boundary delimitation, are in perfect harmony with international law, and their individual and joint statements on Arctic policy emphasize legal commitments and international institutions. The political stability deriving from this determination to deal cooperatively with interdependent management problems is reinforced by a legal framework allocating regulatory and enforcement jurisdiction over Arctic economic activities in a way that is differentiated, globally legitimate, and clearly in the interest of leading Arctic states. That legal framework is dynamic, committing states to strengthen provisions if necessary to protect the Arctic environment from possible adverse effects of greater exploitation of regional resources and trading routes.

26.3 Dynamic Means of Multi-level Governance

Recognition that the Arctic remains politically stable despite rapid environmental change does not imply complacency about the current regulation of economic activities in the region. Unlike those who see the adoption of a region-wide binding environmental protection treaty as the best way forward, however, I seek to show that effective means for addressing such key issues as climate change, marine pollution from land-based sources, shipping, fisheries management and petroleum activities are either broader or narrower than the leading circumpolar institution, the Arctic Council.

The limited potential of Arctic institutions to handle important governance challenges is evident in such areas as global warming and regional bioaccumulation of hazardous substances. Many of the rapid changes currently underway in the Arctic natural environment are due to climate change – but a relatively young, soft-law institution with narrow membership, like the Arctic Council, can play at most a modest role in efforts to combat this essentially global problem [26]. For two decades now, mitigation of greenhouse gas emissions has been addressed under the *United Nations Framework Convention on Climate Change* [55] and other international institutions. Similar comments apply to various other hazardous compounds cold-trapped and bio-accumulating in Arctic ecosystems and threatening the health of Arctic residents [52]. The Pole-bound atmospheric and oceanic circulation systems, and rivers draining into the Arctic seas, transport a range of toxic substances that originate or volatilize further south – including heavy metals and such persistent organic pollutants (POPs) as organochlorine pesticides used in agriculture, industrial chemicals, and a range of combustion products. Regional institutions cannot deal seriously with these problems without engaging other international institutions that have broader participation. When seeking international regulatory action in the late 1980s, therefore, Canada focused first on protocols under the *Convention on Long-Range Transboundary Air Pollution* [19], which covers Europe and North America, and later on the UN Environment Programme (UNEP), which provided the venue for negotiating the global convention [41, 44]. The Arctic Council has indeed generated significant inputs to these various broader processes, but mitigation of climate change and regional exposure to hazardous substances requires action under regimes with broader membership.

Broader regimes are necessary also to deal effectively with the challenges stemming from the rise in Arctic maritime transport. While in some issue areas, such as marine pollution or sea-bed activities under national jurisdiction, UNCLOS encourages regional initiatives or even defines global minimum standards, the situation is quite the opposite for navigation. UNCLOS Article 211 sets *maximum* standards concerning what states may request of a vessel flagged by another state – and those regulatory ceilings become lower the further away from the coastline a vessel operates. In ports and internal waters, coastal states have the same monopoly on regulation and rule enforcement concerning all activities as they do on land: states 'which establish particular requirements' have only to 'give due publicity to such requirements' and communicate these to the 'competent international organization' – meaning the International Maritime Organization (IMO), a specialized agency under the UN. In their territorial seas as well, states are free to 'adopt laws and regulations for the prevention, reduction and control of marine pollution from foreign vessels' as long as such measures do not impede innocent passage or restrict vessel design equipment or manning. In the EEZ, however, scant leeway remains: coastal states can unilaterally only set rules 'conforming to and giving effect to generally accepted international rules and standards established through the competent international organization or general diplomatic conference' – which again is the IMO. Should the coastal state consider those rules and standards inadequate for certain sensitive areas, it must seek approval from the IMO even for relatively modest interventions such as compulsory pilotage or requirements to use particular sea lanes to reduce the risks of grounding or collision. Any additional measures taken by the coastal state 'shall not require foreign vessels to observe design, construction, manning or equipment standards other than generally accepted international rules and standards'. Thus, when states proposed around 1990 to negotiate a polar code specifying and harmonizing construction, design, equipment and other requirements for vessel operations in partly ice-covered waters, they focused on the IMO [15]. In 2002, the IMO adopted its non-mandatory *Guidelines for Ships Operating in Arctic Ice-covered Waters*

[27, 28], revised in 2009 along with a decision to commence work on a mandatory code aimed for completion in 2012 [20]. Elevation of the voluntary polar guidelines to mandatory status is among the recommendations of the Arctic Council's Arctic Marine Shipping Assessment [8]. Thus, as with climate and toxics issues, Arctic institutions do have a role to play regarding vessel construction and equipment rules – but only in conjunction with broader regimes.

As regards governance of Arctic fisheries and petroleum resources, in contrast, circumpolar institutions are eclipsed not by broader regimes but by *narrower* ones. Conservation and use of fisheries resources are among the issues where UNCLOS encourages regional management regimes (Articles 63–64 and 116–119), but 'regionality' here refers to the set of states engaged in harvesting the same stock, based either on zonal attachment or on historical catches [47]. For stocks straddling the high seas and coastal-state zones, parties to the Fish Stocks Agreement [53] may not legally allow their fishers to operate in an area regulated by a regional regime without joining or cooperating with it (Article 8 of the Agreement; [48]). However, a stock that gradually changes its migratory pattern due to temperature changes and becomes increasingly available in Arctic waters is unlikely to be harvested by all Arctic states. Moreover, zonal attachment or historical catches might imply that certain non-Arctic states have legitimate interests in the stock. Non-Arctic state membership marks the North-East Atlantic Fisheries Commission, which has regulatory competence with respect to high-seas areas in the European segment of the Arctic Ocean. The operation of regional fisheries regimes will be necessary in the Arctic Ocean, but probably not a circumpolar regime.

Also for petroleum activities, international law supports a regional approach – but again, the Arctic eight are not the most promising state grouping for achieving regulatory progress. UNCLOS provides that in adopting laws and regulations to prevent, reduce, and control pollution from sea-bed activities under national jurisdiction, states 'shall endeavour to harmonize their policies in this connection at the appropriate regional level' (Article 207 of UNCLOS). Despite this encouragement, there have been no attempts within the Arctic Council to create rules that are more ambitious or that exercise greater normative pull than those already embraced in broader international fora. The soft-law standards contained in its Arctic Offshore Oil and Gas Guidelines [9], reviewed and updated in 2009, are derived from and invoke existing and legally binding instruments – including UNCLOS, various agreements drawn up under the IMO, and regional treaties [34]. One reason for such non-assertiveness on the part of the Arctic Council is that vulnerability to oil-spill damage is primarily sub-regional rather than circumpolar. Moreover, the five Arctic coastal states have few incentives for negotiating constraint on their exercise of sovereignty concerning a sector of strategic significance within a venue framework that includes non-coastal states as well. Thirdly, there already exists in the European segment of the Arctic an institution that covers also non-Arctic areas and already engages in rule-making: the regime based on the *Convention for the Protection of the Marine Environment of the North-East Atlantic* [36] has passed several legally binding decisions under an Offshore Oil and Gas Industry Strategy pertaining to best available technology requirements and discharges from platforms and refineries [29].

Russia is currently the only state bordering on the Northeast Atlantic that is not a signatory to that agreement. As with fisheries, various sub-regional institutions are probably better placed than the Arctic Council to provide venues for stronger international commitments regarding coastal-state rules on petroleum activities on their continental shelves.

In all the sectors likely to see rising economic activity, therefore, the Arctic Council is poorly equipped to play decisive regulatory roles. Broader institutions will continue to predominate in the international governance of maritime transport as well as the wide range of activities that generate greenhouse gases or toxic compounds affecting Arctic ecosystems. Narrower institutions, either coastal states or international arrangement involving subsets of them, are better placed for effectively managing the rise of regional offshore petroleum activities or the greater availability of commercial fish stocks. As shown in the next section, however, regional institutions may play important roles in supporting such broader or narrower institutions in the provision of good governance in the Arctic Ocean.

26.4 Regional Council, Wider Involvement

The differential allocation of competence to regulate economic activities in the Arctic calls for multi-level governance, with some implications for how regional institutions should relate to non-Arctic states and actors. The Arctic Council is particularly well-placed to contribute to knowledge-building about environmental threats and capacity-building for dealing with them, two governance tasks that may also support regulatory advances in broader or narrower regimes with stronger mandates. Such contributions will be more forceful if the Council manages to involve interested non-Arctic states in ways that raise their awareness of the Arctic dimensions of wider problems and their preparedness to support the necessary strengthening of broader regimes.

The extent and mode of involving non-Arctic states in work under the Arctic Council is controversial, as was evident in the Council's 2009 rejection of applications by the European Commission, Italy, China, and South Korea for permanent observer status. Six states, nine international organizations and eleven non-governmental organizations already enjoy such status, which implies the right to attend and, subject to the Chair's discretion, address meetings under the Council (Arctic Council, Rules of Procedure, Articles 36–38). The most recent ministerial meeting decided to 'continue discussing the role of observers in the Arctic Council' [10, 11]. Among the reasons cited by sceptics to broader involvement of non-regional actors in the Arctic Council are fears that more observer states will reduce the special role of indigenous peoples as Permanent Participants, and anger with a recent European Union decision to ban imports of seal-skin products, perceived as lack of sensitivity to Arctic affairs. Griffiths [25] discusses (and dismisses) fears that broader involvement will necessarily reduce Permanent Participant influence; and Canada's Foreign Minister Lawrence Cannon (cited in [40]), holds European Union seal-product policy as reason to exclude the European Commission. The observer discussion does not seem to have given much emphasis to whether and how broader involvement of non-Arctic actors might affect the ability of the Arctic Council to contribute effectively to the overall governance system of Arctic activities. In the following I distinguish between three kinds of such contributions – cognitional, catalytic, and capacity-enhancement.

One important governance task where contributions by non-Arctic states are valuable is cognitional – the generation of knowledge about the severity of a problem and of the effects of various options for dealing with it. Collaborative knowledge-building has emerged as the ‘specialization of the Arctic Council’ [45], not least through a series of assessment reports on the state of the Arctic environment and the challenges and opportunities associated with Arctic change in key sectors like petroleum and shipping [52]. These cognitional contributions by the Arctic Council already benefit from broader cooperative endeavours. The ambitious Arctic Climate Impact Assessment, for instance, was implemented in cooperation with the International Arctic Science Committee, based in Germany and involving numerous non-Arctic states. The Arctic Council’s Thematic Data Centre for marine information is located at the International Council for the Exploration of the Sea, an international organization coordinating assessment of fish stocks and the marine environment in the North Atlantic. Similarly, the Council’s Circumpolar Biodiversity Monitoring Programme is closely linked to the UNEP World Conservation Monitoring Centre [52]. Such nesting of Arctic monitoring and research activities within broader programmes is advantageous not only for cost-efficiency reasons: it also ensures access to relevant expertise and activities found and financed beyond the region. More than 60 states participated in the research coordinated under the International Polar Year 2007–2008, including those applying for permanent observer status in the Arctic Council. The Council’s cognitional contributions clearly stand to gain from greater involvement of non-Arctic states in its research and assessment work.

Similar comments are in order regarding a second governance task, catalysing stronger regulatory provisions in broader institutions. Such catalytic aspiration is evident in the recommendation in the Arctic Marine Shipping Assessment [8] to upgrade the voluntary polar shipping guidelines [27] to a legally binding polar code under the IMO. An even clearer example is the role of Arctic Council activities in the strengthening of international rules regarding discharges, storage and trade of hazardous compounds. Among the major messages from the environmental assessment reports produced under the Council is that the effects of POPs and heavy metals on humans are more dramatic in the Arctic than those documented at lower latitudes [4, 5, 7]. Such substances bio-accumulate in the fatty tissue and blood of some species, including marine mammals and sea birds that are important in the diet of Arctic indigenous residents [21]. The focus of these assessments on transport pathways and health impact glove-fitted the four criteria developed under CLRTAP [19] to identify chemical substances in particular need of regulation: transport range, persistency, toxicity and bioaccumulation ([44]: 142). The substances that were selected from an initial list of more than a hundred included those of greatest relevance to Arctic ecosystems. Yet another instance of Arctic Council aspirations to influence broader governance processes is the Arctic Climate Impact Assessment [3], factored into the broader assessment work under the Intergovernmental Panel on Climate Change. The ACIA reports and a policy document containing some of the clearest statements subscribed to by the George W. Bush administration on the need for action on global warming were widely disseminated in the United States, where policymakers and the general public have traditionally viewed ‘climate science’ with scepticism [26]. In short, whether the subject matter is shipping, toxics or climate change, Arctic Council assessment reports have raised the saliency of the Arctic dimension of broader problems and helped to mobilize political energy also among non-regional states. Wider involvement of non-Arctic states will enhance the Arctic Council’s ability to catalyse regulatory advances in broader institutions with relevant competence by expanding the set of states and actors with ownership in Arctic Council assessments and recommendations.

A third governance task assumed by the Arctic Council and likely to benefit from broader involvement of non-Arctic actors is capacity enhancement. Of particular relevance here is the Council’s Arctic Contaminants Action Program (ACAP), a collaborative structure for defining and implementing practical problem-solving projects, primarily in Russia. The programme implies some political commitment among member states to contribute resources, but the main rationale is to stimulate broader use of state-of-the-art approaches and technologies for effective toxics management. A range of projects aim to deal with existing stockpiles of polychlorinated biphenyls (PCBs) and obsolete or prohibited pesticides in Russia, by mapping stockpiles, improving storage and demonstrating destruction [1]. Other projects target mercury, dioxins, and brominated flame retardants – thus far only by mapping releases, concentrations and options for cleaner production options and by defining pilot projects [2]. As with environmental monitoring and research, these Arctic Council capacity-enhancement efforts are nested within broader normative endeavours and programme activities and sometimes involve external financial support. Early on, UNEP-Chemicals Programme provided secretarial services for the ACAP project on obsolete pesticides, and is also involved in projects that address mercury, dioxins and furans. Similarly, the Regional Programme of Action for the Protection of the Arctic Marine Environment from Land-Based Activities [38] is explicitly linked to UNEP’s corresponding global endeavour. Under this programme, PAME has been instrumental in attracting financial support for the Russian National Plan of Action from international financing institutions, including several projects approved by the Global Environment Facility. The ability to extract funds from broader institutions for Arctic capacity-enhancement projects can be further boosted by wider involvement of non-Arctic states in Arctic Council activities.

In short, the valuable contributions of the Arctic Council to good governance of activities impacting on the Arctic environment will be further enhanced if the Council can manage to involve non-Arctic states in ways that raise their participation and ownership in assessment and recommendation work, thereby promoting the regulatory dynamics or the capacity-enhancement processes within broader institutions affecting the regional environment.

26.5 Conclusions

Despite rapid environmental change in the Arctic, political stability remains high. The Arctic states have relatively few unsettled maritime boundary issues, manage the remaining issues in a cooperative manner, and articulate their Arctic aspirations in policy documents that emphasize the rule of law and the need for international cooperation. Moreover, there already exists a legally binding, globally legitimate legal framework for governing those economic uses of the region that are likely to expand, one allowing differentiated responses to new challenges deriving from increasing economic activities. Those adequate responses must involve other institutions besides regional ones like the Arctic Council, because many of the regional environmental problems originate outside the Arctic or involve actors beyond the jurisdictional reach of regional states. The fact that Arctic environmental challenges cannot be addressed without significant contributions from broader or global institutions also raises the question of how the Arctic Council should deal with the interest shown by certain non-Arctic states to participate in Council work. Important governance functions – like generating knowledge about regional risks and response options, achieving broadly applicable regulations that are sensitive to Arctic concerns, and mobilizing resources and legal competence necessary for rule implementation – stand to benefit from greater involvement of other interested states, for instance as observers under the Council. Provision of effective and legitimate governance remains the best basis for ensuring political stability in the Arctic.

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Chapter 27
Arctic Science in the Common Interest

Steven C. Bigras

Abstract The international polar research community has just finished celebrating the 125th anniversary of the first International Polar Year (IPY) 1882–1883. Although the full impact and benefits of IPY 2007–2008 will not be felt for some years – many of its research projects and activities are still underway – attention has now shifted to the legacy aspects of IPY. Over the course of IPY 2007–2008, Arctic nations offered non-Arctic nations unprecedented access to Arctic research infrastructure (e.g. research stations, observation and monitoring networks). Despite the growing body of knowledge, we do not completely understand the potential environmental and social consequences of rapid climate change in the Arctic. The region is attracting international interest for its resource potential, possible new shipping routes as a result of decreasing ice cover, and international boundary and sovereign rights issues that have not yet been settled. Along with climate change, Arctic residents will have to overcome many other challenges such as large-scale economic development, and accelerating health and social issues in communities. Sound knowledge-based strategies are needed to help address the cumulative effects of climate change while taking into account multi-jurisdictional regulations and interests, and environmental impacts. These must involve responsible economic development, sustainable communities, and the use of local expertise in northern communities. This paper examines the need for a sound understanding of the processes at work in the Arctic, a solid bridge that links science and policy, and the importance of long-term sustainable scientific collaboration to improving governance and avoiding conflict in Arctic regions.

S.C. Bigras (✉)
Executive Director (retired), Canadian Polar Commission, Ottawa, Canada
e-mail: steven.bigras@rogers.com

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27.1 Introduction

The international polar research community has just finished celebrating the 125th anniversary of the first International Polar Year (IPY) 1882–1883 and the 50th anniversary of the first International Geophysical Year (IGY) 1957–1958. Like its predecessors, the fourth IPY 2007–2008 is expected to constitute a major landmark for international polar science.

Over the last 24 months the world's polar research community came together in a flurry of coordinated scientific activity at both ends of the globe. Hundreds of research and outreach projects undertaken by thousands of scientists from over 60 countries are giving us better understanding of the physical, chemical and biological processes near the poles and bringing new insights into the circumstances – past, present and future – of those who live in the circumpolar world.

Although the full impact and benefits of IPY will not be felt for some years – many of its research projects, data management initiatives, and outreach and training activities are still underway – attention has shifted to the legacy aspects of IPY, and the question of how to maintain large-scale multinational interdisciplinary research programs.

Over the course of IPY 2007–2008, cooperation and collaboration formed the cornerstone of the IPY research projects and resulted in unprecedented access to Arctic research infrastructure (e.g. research stations, observation and monitoring networks). Many nations expanded their national Arctic research programs, and made substantial investments to support their scientists. A number of extensive multidisciplinary networks were established. An extraordinary amount of information from this international effort has been collected and is still being analyzed.

IPY 2007–2008 has already left a large legacy footprint. It has demonstrated the advantage of working together through bilateral and multilateral agreements, and it has inspired a new generation of polar scientists to keep pooling their resources, form solid partnerships, share information, and ultimately generate a greater understanding and appreciation for the Arctic. This is very timely, given the decreasing ice cover and increased accessibility to the Arctic Ocean basin, and the drive for resource exploration and development.

The Arctic Ocean basin is a complex and diverse environment shared by five Arctic states: Russia, Canada, USA, Finland and Denmark/Greenland Cooperation among them is often difficult, as each has its own political and social agenda. The five nations, however, share interests such as trade and transportation, environmental protection and security, natural resource development, the role of indigenous peoples, oceans management, climate change adaptation, and scientific cooperation.

Today more than ever there is a need for scientific and research collaboration and cooperation in these shared areas of interest. The interest in and drive for economic development and resource exploration and extraction by Arctic as well as non-Arctic nations in the Arctic Ocean is escalating. This underscores the need for informed and responsible decision making to ensure the safety and security of people living and working in Arctic communities and to maintain the integrity of the northern environment for current and future users.

This paper discusses the need for sustainable international research programs, the importance of long-term scientific collaboration in Arctic regions, and the value of involving Arctic residents in the decision-making processes.

27.2 Climate Change: The Game Changer

Research results have already shown that climate change has destabilized Arctic ecosystems including sea ice, the Greenland ice sheet, mountain glaciers, permafrost, and vegetation. The impact of these changes on the physical and biological systems, as well as on people, is large and projected to grow.

As a result of the decreasing ice cover – in particular multi-year ice – the Arctic is becoming more accessible. Arctic regions are fast becoming new frontiers for economic development opportunities including resource exploitation, and political disputes, and as a result are receiving an unprecedented amount of international attention. We need to ensure that there is a solid understanding of the environmental processes at work in the Arctic and that there is a strong link connecting science and policy. The knowledge and information gained over the next few years must form the bases for the decisions and actions that governments will take to mitigate or adapt to change in the Arctic.

The research has demonstrated the direct links between the Arctic regions and the rest of the planet. We now know that these regions are feeling the effects of global climate change more intensely than anywhere else on Earth. Despite the growing body of research we do not yet completely understand the potential consequences of climate change in the Arctic.

The effective application of accumulated knowledge requires the development of sound comprehensive strategies that can help address the cumulative effects of climate change and take into account various stakeholders, multi-jurisdictional regulations and interests, environmental impacts and other concerns specific to the Arctic. Fundamental to such a course of action are responsible economic development, sustainable communities, the commitment to achieving consensus between parties, and the use of traditional knowledge.

Along with climate change, Arctic residents will have many other challenges to overcome and difficult questions to resolve: potential geopolitical disputes, an increase in commercial shipping, economic development including large scale industry, security concerns, emerging health and social issues in northern communities, and how to work with non-Arctic nations to accommodate their interests in economic development and governance of the Arctic.

The following sections provide an overview of some of the more pressing impacts of climate change and provide a context for the role international scientific collaboration and cooperation can play in addressing them. By no means should it be considered a comprehensive review of climate change impacts.

27.3 The Environment

There is tremendous diversity in the environment and ecosystems of the north. Many Northerners depend on the environment for their subsistence and cultural needs; and many other Canadians benefit from visiting and enjoying the vast wilderness areas across the north, which also brings tourism employment to communities. Recent years have seen increased development across the north.

Imbalance of species distribution, impact of invasive species, changes of migration patterns, productivity changes and a longer growing seasons have all been raised as long-term impacts of climate change, as have the effects of permafrost change the integrity of ecosystems, landforms, and infrastructure. Long-term data will be required to distinguish long-term permanent change from short-term variability.

Of particular concern to the people in the north is the long-term impact on country foods. In 25 years' time the critical questions will be the availability and sustainability of seal, whale, caribou, waterfowl, and fish for communities in their current locations. The regimes of rivers and lakes are already changing and affecting physical conditions, ecology, and the economy. There is concern about changes in the quantity and timing of the freshwater input to the Arctic Ocean, the effects on atmosphere–ocean interactions, and changes near the shore. Permafrost and glacier melt will increase the sediment load of rivers, stressing the ecology of the rivers and near-shore zones at the mouths of rivers. These environments are critical to country food species such as beluga and fish.

Baseline environmental data is being collected and environmental assessment techniques for northern ecosystems are being formulated to ensure timely and accurate assessment of future developments, and their effective management and impacts.

Environmental change is occurring at an unprecedented rate, highlighting the need for monitoring to help provide the information required for informed decisions. To this end, efforts are underway to better coordinate monitoring sites around the circumpolar north. Connecting terrestrial and ocean observatories sites is critical for coverage across the Arctic Basin to provide a complete picture of climate change and its effects. This is being undertaken by the Sustaining Arctic Observation Networks project.

27.4 Social Transformation

Weather patterns and ice conditions are becoming less predictable, which is a concern to local hunters. In order for northern communities to take advantage of economic development opportunities, higher levels of school completion and training will be needed. Assessment of the potential impact of developments on communities must also be conducted to ensure that they benefit, rather than harm, the social, health, and general well-being of Canada's northern citizens.

Communities across the north share many challenges. While some in larger centres enjoy living standards similar to the south, small communities face isolation, high costs of living, and extreme social and health problems. Many northern residents rely on the land to provide their food, but the availability and safety of country foods can be compromised by external factors such as climate change and airborne pollutants. Large-scale developments such as pipelines, mines, and oil and gas present additional challenges to the social structure of northern communities. Large influxes of people and money, while providing northerners with opportunities, can seriously impact communities where people generally wish to participate in the wage economy without compromising their ability to hunt, trap and fish.

Health issues often reflect changes in cultural, social, and environmental conditions. In the North, changes in these factors have placed enormous stress on populations. The current focus on nutrition, social and mental health issues will continue in the short and medium terms but change will bring new stressors in the medium to long term. Vulnerability to new diseases among northern people differs from the national population and may be related to genetic as well as behavioral and environmental factors. As a result of climate and other forms of change, new diseases may become more common (e,g., diabetes).

27.5 Economic Prospects

The Arctic is no longer seen as a harsh inaccessible region, but rather one with considerable economic and investment potential. By all accounts it is about to become a very busy place.

The Arctic holds the promise of substantial resources, including large oil and gas deposits, minerals, and fish. Polar transportation routes are also being considered by Russia, Europe and China and may result in increased commercial traffic in the Arctic Ocean. More attention will have to be paid to regulation and enforcement in Arctic waters. Search and Rescue (S&R) capabilities will also have to be coordinated and the responsibility and cost for providing S&R will have to be shared.

It is necessary to understand the importance of infrastructure in the Arctic, and this is especially so for the oil and gas industry. Different requirements for safety and security for people living and working in the Arctic will be necessary. Specialized northern knowledge and technology are required to provide tools for northern development, environmental protection, and improved living conditions for northern residents.

Development activities such as construction, power generation and distribution, and transportation have to deal with some unique conditions in the north. Extreme cold, permafrost, low daylight hours in winter and limited transportation infrastructure are some examples. In many cases, specialized technologies are needed to address these challenges because those developed in more southern latitudes cannot do the job.

Ice hazards to shipping in the Arctic Ocean basin will remain high for the foreseeable future with risks to safety and the potential for environmental disasters. Transport of people and goods – particularly illegal transport – through Arctic waters may pose a security risk.

Given the increased commercial shipping and tourist traffic it is likely that international consortiums will be formed to develop large-scale infrastructure that will be used by transport companies from many countries. This type of construction should be planned so as to bring benefit to northern communities, and indigenous organisations and northerners need a role in the decision-making process. This is particularly relevant when looking at the implementation of guidelines, and the development of best practices and negotiating policy instruments. Guidelines for shipping and transportation that will protect Arctic environment and people need to be developed in cooperation with non-arctic nations as well. This type of cooperation can also be very helpful in advancing international cooperation where S&R operations are concerned.

As activity increases, the need for cold weather technologies, winter and all-season roads, access to electricity, and construction in and outside existing communities will also increase. Large-scale projects like pipelines, hydroelectric projects, railways, and mines will all depend on state-of-the-art northern technology in order to avoid malfunctions and to minimize negative impacts on the environment. There is interest in decreasing the north's reliance on diesel-generated electricity and this will require specialized technology for alternative power sources such as micro hydro or wind generation that can operate under northern conditions.

It cannot be stressed enough that arctic residents must be involved in decision-making on resource development and safety and security. Development of hydrocarbon resources, transportation routes, or tourism must be undertaken in a reasonable and responsible manner using advanced technology and best practices and procedures.

27.6 Geopolitics

Arctic coastal states encircling the Arctic Ocean are also looking to enlarge their Exclusive Economic Zones, the areas over which they can exercise jurisdiction– including the resources under the sea bed. Fortunately most of the Arctic coastal states are undertaking this expansion in an orderly manner as outlined in the guidelines set out under *United Nations Convention on the Law of the Sea* [4] – Article 76.

Moreover, all five Arctic coastal states have a common commitment to orderly settlement of any possible overlapping claims as outlined in the *Ilulissat Declaration* [1] and have agreed to work together towards the responsible management of the unique Arctic ecosystem.

However, disputes related to natural resources may arise. International companies may seek to work outside national borders and at the international level through such fora as the World Transportation Organization or the International Seabed Authorities Commission to gain access to resources. These possibilities serve to highlight the importance of existing international mechanisms and agreements for cooperation and settlement of disputes. Bilateral relations with our neighbors in the Arctic through regional mechanisms like the Arctic Council and other multilateral institutions are seen as part of the solution to such situations.

27.7 Science and Technology: Cooperation and Collaboration

It has never been more important for the polar research community to ensure that we continue developing international collaborative research opportunities for citizens, scientists, politicians and policy-makers to work together, to build on the achievements of IPY, and to develop a strategy for future economic development and environmental protection. Clear communication with politicians and policy-makers is challenging but essential, despite the lingering uncertainties in climate-change science. Public awareness helps considerably in getting messages to politicians, and it is therefore important that scientists and researchers share their results not only with colleagues but also with the general public.

International cooperation and Pan-Arctic collaboration have been focusing on capacity development and knowledge generation, but today include developing regulatory and enforcement capabilities. The Arctic states must be able to respond to the increase in international activity that a more accessible Arctic will bring.

Through international cooperation and collaboration programs like IPY 2007–2008 our understanding of the impacts of climate change and the opportunities that come with globalization increase. By working collaboratively, science and technology development will play a critical role in the sustainability and protection of the Arctic.

At first glance present day Arctic research programs seem very fragmented and diverse. The arctic research community includes many players, from regional to international, working to improve our understanding of the environmental, economic and social processes taking place there. There are, however, also international organizations working on pan-Arctic cooperation and collaboration in research: the International Arctic Science Committee; the International Arctic Social Sciences Association; the Northern Forum; the Barents Euro-Arctic Region; Arctic Council; the Indigenous Peoples Secretariat; the University of the Arctic; and the Northern Research Forum to name but a few.

All this activity brings hope for better communications, and more rapid confirmation of scientific data and dissemination of results. We know that policy needs to be based on reliable information; it should also be timely, account for a broad range of perspectives, and be applicable over the long term. Despite the many efforts being made however, there is still a disconnect between what scientists recommend and what policy makers implement.

Can scientific cooperation and collaboration help eliminate this disconnect? We need to keep in mind that the science/policy interface should not be overly complicated. Clear objectives are required, and it is far better to connect policy-makers and scientists early on in a process than in the later stages in order to produce beneficial outcomes.

International collaboration at the scientific level would seem a viable and practical way to enable all interested parties to become more involved in Arctic matters. In order for this approach to succeed, interested nations must show a commitment to substantial research activity in the Arctic, be prepared to share research information, have an active exchange of scientists, and be prepared to support multinational research programs.

An example of such an endeavour is the ocean-bed mapping project under UNCLOS. Here several nations are working together to collect bathymetric readings on the extent of their respective continental shelves. Joint collaborations of this nature offer affordable, reliable data that can be shared and provides decision-makers the most up-to-date, reliable information.

Another concept that has been put forward by Russia and has been gaining increased acceptance among the scientific community is the idea of an International Polar Decade [2] as a legacy aspect of the IPY 2007–2008. The idea is to capitalize on the international collaborative momentum created by IPY 2007–2008 at a time when polar research is central to our understanding of global physical processes and climate change, but is also increasingly threatened by external pressures for economic and resource development.

It is hoped that the Polar Decade will encourage polar research nations to keep working together as they have so successfully done during the IPY 2007–2008, thus maximising efficiencies, reducing costs avoiding overlapping research, and generally providing added value and momentum through rationalization of their logistical networks and scientific resources.

The examples listed above show that there is strength in cooperation and collaboration through international research initiatives and programs. By sharing information we can help mitigate the effects of climate change and avoid unsustainable development in the Arctic.

It is clear that change is needed, both inside and outside of the Arctic, and that it will require new and innovative ideas. We may have to change the way we do research — to rethink the way science interacts with politics and society. There is a need to engage politicians at the highest level so that we may act swiftly to implement sound policies based on scientific results. It is also clear that Indigenous peoples' participation is needed at the beginning of these initiatives and research programs to ensure that policies and their implementation are not removed from the real-life situation in the Arctic.

27.8 Conclusion

The Arctic is touted as a region rich in natural resources, including hydrocarbons, minerals, flora and fauna. It is also home to thousands of people. Accountability and protection are needed to ensure the conservation and sustainability of the region for future generations.

We need to think of managing the Arctic as a process. It needs to be multidisciplinary, integrate both short and long term horizons and involve multi-stakeholder partnerships between governments, civil society, industry and academia. How we undertake the research and communicate the results to decision makers has never been more important. This information will form the bases for the decisions and actions that governments will take as we attempt to mitigate, prepare for, and deal with the effects of climate change in the Arctic.

It is crucial that the polar research community continue to develop international collaborative research opportunities for citizens, scientists, politicians, and policy-makers to work together, to build on the achievements of IPY, and to develop a strategy for future economic development and environmental protection through international cooperation. Clear communication with politicians and policy-makers is challenging but essential. Public awareness helps considerably in getting messages to politicians, and it is therefore vital that scientists and researchers share their results not only with colleagues and decision makers but also with the general public.

Measures must be instituted and research undertaken to ensure that there is a solid understanding of the processes at work in the Arctic and that a sturdy bridge links science and policy. In order to obtain a more comprehensive understanding of the processes at work and their potential impacts on people and the environment in the North and globally, the international research community will need to collaborate and cooperate – especially given the high cost and long term commitment needed to obtain all the information needed to make sound decisions. No one nation can be expected to undertake this work alone, or can afford to sustain it financially.

It was encouraging to hear Prime Minister Putin, in a speech to a September 2010 international Arctic forum hosted by the Russian Geographical Society at the University of Moscow, emphasize the fact that the Arctic's rich mineral resources can be developed cooperatively, with disputes being resolved peacefully, and with concern for the environment. His fundamental message was in the title of the international forum: *"The Arctic: Territory of Dialogue"* [3].

Increased dialogue with arctic and non-arctic nations will have to start at both at the governmental and non-governmental levels. Greater involvement of non-governmental international organizations to coordinate Arctic and Antarctic polar science will be a key component in an international effort to gain knowledge. The knowledge and information acquired must be shared in a timely manner as it will form the bases for government decisions and actions in response to changes in the Arctic. Long-term research plans need to be developed now so that we can provide policy makers and the global community with clear answers, backed up by solid scientific information, rapidly and efficiently. It is especially crucial that these steps be taken today.

Sound, comprehensive, and knowledge-based strategies are needed to help address the cumulative effects of climate change while taking into account various stakeholders, multi-jurisdictional regulations and interests, environmental impacts, and other concerns specific to the Arctic. These must involve responsible economic development, sustainable communities, a commitment to achieving consensus, and the use of local expertise in northern communities. By undertaking collaborative research at the international level and engaging indigenous people and northerners in the dialogue we have a better chance of balancing social, economic and environmental objectives while meeting national and international development objectives – without compromising the future of the Arctic.

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Chapter 28
Achieving Environmental Security in the Arctic Ocean: The Institutional Challenges

Ingo Winkelmann*

Abstract The contribution puts the question of who deals with present challenges of globalization in the Arctic Ocean. It argues that there are a number of qualified observers of the Arctic game who can claim that events in the polar region have a considerable impact on them. The *"stewardship"* by the coastal States of the Arctic Ocean, as expressed in their *Ilulissat Declaration* (Ilulissat Declaration, Arctic Ocean conference, 27 May 2008. http://www.oceanlaw.org/downloads/arctic/Ilulissat_Declaration.pdf.), should be exercised in the interest of all humankind and carries with it an obligation to address the institutional interplay. To shed more light on this interplay, the contribution examines the existing institutional regional structures that deal with the affairs and impact of environmental change in the Arctic, in particular in the Arctic Ocean. Specific attention is given to the Arctic Council, the apparently existing hierarchy amongst Arctic Council members, membership and observership in the Council, security aspects, the provisions of the Law of the Sea as enshrined in UNCLOS (1982. United Nations Convention on the Law of the Sea. http://www.un.org/Depts/los/convention_agreements/texts/unclos/closindx.htm.) (including the Commission on the Limits of the Continental Shelf) and the yearly United Nations General Assembly (UNGA) resolutions on oceans and law of the sea. The contribution concludes that improvements could be made in regard to the Arctic Councils' structures, it rules of procedure, the possibility of an UNCLOS implementation agreement and, finally, appropriate amendments to relevant UNGA Resolutions. The contribution reaffirms finally that Arctic Ocean matters are matters of global importance.

*The opinions given in this commentary are those of the author, former Head of the Division for the Law of the Sea and the Antarctica (2008–2011), and do not necessarily reflect those of the Federal Foreign Office or other government offices.

I. Winkelmann (✉)
German Federal Foreign Office, Auswärtiges Amt,
Werderscher Markt 10117, Berlin 11013, Germany
e-mail: v@bangk.auswaertiges-amt.de

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28.1 Introduction

For decades, if not centuries, the states of the North Polar region have tackled the questions of their region with their own traditional expertise and through existing neighbourly links. But now, the new challenges of climate change – including the multiple impact of globalization - and its dramatic consequences for a number of Arctic "playing fields" have put the question of who deals with these challenges at whose table back on the agenda.

It is undisputed that Arctic matters are firstly an issue for the Arctic actors themselves. They have the first say. This is self-evident and in no way dependent on the fact that the Arctic includes both (undisputed) land areas as well as territorial and high sea areas. At the same time, there are a number of qualified observers of the Arctic game who can claim that events in the polar region have a considerable impact on them. Should they be left out when it comes to coping with the challenges of the Arctic [9]? The *"stewardship"* exercised by the five coastal States of the Arctic Ocean,[1] as expressed in their *Ilulissat Declaration* [26], is in the interest of all humankind and carries with it an obligation to address the institutional interplay [10]. To shed more light on this interplay it might be helpful to examine the existing institutional regional structures which have been created to deal with the affairs and impact of environmental change in the Arctic, in particular in the Arctic Ocean.

28.2 The Arctic Council

Established by the *Ottawa Declaration* [32], the Arctic Council is a *"high level forum"* with all eight Arctic states as members,[2] six Indigenous Peoples Organisations as permanent participants[3] and a number of observers including international organisations, non-governmental organisations and non-Arctic States [11]. The latter encompass the following six States: France, Germany, Poland, Spain, the Netherlands and the United Kingdom. Germany, Poland, the Netherlands and the United Kingdom were already present during the negotiation of the Arctic Environment Protection Strategy [2], which led 5 years later to the establishment of the Arctic Council.

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[1] Canada, Denmark, Norway, Russian Federation and the United States as the "*five coastal States.*" Iceland was not included as an Arctic coastal state in the *Ilulissat Declaration* [26].

[2] The five coastal states in Footnote 1 (above) plus Iceland and along with Finland and Sweden, which do not have coastal boundaries in the Arctic Ocean.

[3] Aleut International Association (AIA), Arctic Athabaskan Council (AAC), Gwich'in Council International (GCI), Inuit Circumpolar Council (ICC), Saami Council, Russian Arctic Indigenous Peoples of the North (RAIPON).

The 1996 *Ottawa Declaration* formally established the Arctic Council as an intergovernmental forum to:

> *provide a means for promoting cooperation, coordination and interaction among the Arctic States, with the involvement of the Arctic indigenous communities and other Arctic inhabitants on common arctic issues*, in particular issues of sustainable development and environmental protection in the Arctic.*

As a result, a number of important scientific assessments have been produced by the six working groups of the Arctic Council, such as the Arctic Climate Impact Assessment [1, 6]. While the Arctic Council tackles numerous other important tasks as well, its structures remain flexible and intergovernmental in essence. This has been shown by the absence of a permanent secretariat, although a standing Arctic Council secretariat was recently established [31], the absence of a budget of its own and the fact that the instruments adopted by the Council are not of a legally binding nature.

There is no question that the Arctic Council is the central institution in the region. Its pivotal role is in no way diminished by the existence of other institutions active in parts of the region, such as the Euro-Barents Council [21], the Baltic Sea Council and others.

28.2.1 Hierarchy Amongst Arctic Council Members?

The meetings of the Council – at Senior Arctic Official or Ministerial level – have usually involved the eight members of the Council. Recent meetings of a limited number of Arctic Council members have raised questions. Meetings like the one in Ilulissat, Greenland [26], and the one in Chelsea, Canada (Foreign Affairs and International Trade Canada 2010), were held in a format of only five of the eight members. This has helped foster the impression that a new hierarchy of membership is developing within the Arctic Council. Beyond the traditional categories of members, permanent participants and observers, a new, maybe privileged category of 'members with an Arctic Ocean coast' seems to be emerging. This new category comprises the five Arctic coastal state participants of the meetings in Ilulissat and Chelsea, the five coastal States of the Arctic Ocean: Canada, Denmark, Norway, the Russian Federation and the United States.

The *Ilulissat Declaration* [26] makes explicit reference to the *"sovereignty, sovereign rights and jurisdiction",* in short the *"stewardship,"* of the coastal States [9]. Mention is made of responsible management by the five coastal States, cooperation among the five and other interested parties to ensure the protection of the fragile marine environment of the Arctic Ocean, as well as the general need for cooperation as a prerequisite for addressing many of the Arctic challenges [38]. This common approach by the so-called 'Arctic Five' was certainly motivated by their eagerness to demonstrate adherence to the international rules governing the delimitation of outer limits of national continental shelves in the Arctic Ocean. The Chelsea meeting in 2010 reaffirmed this principle, mentioning also the positive impact of international cooperation with regard to new public safety challenges. However, some reactions show that not all 'Arctic 5' are entirely at ease with the new format [16]. As true as it is that the 'Arctic 5' committed themselves to diplomatic, peaceful solutions of Arctic Ocean border issues using UNCLOS [36], there seems to be an awareness that the new category bears the risk of dividing the original members of the Council into two classes, also leaving the (indigenous) permanent participants behind. Indeed, on the eve of the meeting in Chelsea, Inuit leaders charged the Canadian government of shutting them out of the Arctic summit and called for Inuit participation at the meeting [27].

28.2.2 Membership and Observership in the Council

The number of state observers has been relatively stable since the establishment of the Council. This situation might change – at least the applicants hope it will. The dramatic new developments in the Arctic environment are of global importance: scientific models of climate change, the likely emergence of new shipping routes and prospects of new mineral resources are of interest not only to Arctic neighbours but also to many States outside the region. This is one of the main reasons for a number of new candidatures for observer status to the Council. Recent applications come, for example, from the European Union, China and South Korea. The Council seems to be undecided whether to respond favourably or not to these applications. For the time being, it appears to be rather reluctant. Even longstanding observers were recently asked to prove the substance of their status when the acting Presidency asked them to submit to the Arctic Council up-to-date information about "relevant activities" [4]. The European Union has been most outspoken about its political interest in becoming an actor on Arctic issues, for example, a Communication from the European Commission [17] titles one of its chapters "*Contributing to Enhanced Arctic Multilateral Governance*" by:

- Assessing the need for new measures;
- Monitoring the progress of territorial claims;
- Considering new approaches for multi-sector management for ecosystems;
- Striving for a permanent observer status for the EU;
- Developing the use of the Northern Dimension framework

Observers describe the agenda of the European Commission as being "*ambitious, detailed and self-assertive, covering all dimensions of the classic High North agenda*" [7]. Previously, the European Parliament [19] had even spoken out in favour of *"pursuing the opening of international negotiations designed to lead to the adoption of an international treaty for the protection of the Arctic",* adding that *"as a minimum starting point such a treaty could at least cover the unpopulated and unclaimed areas at the centre of the Arctic Ocean."*

The most recent European Union documents are from the European Council [18] and again from the European Parliament [20]. These documents are, as has been noted [7], shorter and more low-key as the previous European Union documents, having as their main theme environmental protection.

It will be interesting to see how the discussion develops, not only with regard to the emerging European strategy but also with regard to other players, especially in relation to the *"criteria for admitting observers and role for their participation in the Arctic Council,"* as described in the 2011 report from the Senior Arctic Officials [34]. The *"limiting condition is how far the US, Russia and Canada will let (other) groupings into the game"* [7]. Rather, it is about harmonizing two imperatives: not watering down the Arctic nations' centuries of experience and ensuing responsibility for their neighbourhood, but also not ignoring the inputs offered and adequate participation sought by qualified and concerned Arctic "outsiders". This subtle balance is not easy to achieve. Compromises will be needed as well as mutual respect and acknowledgment of existing expertise. In the long run, inclusive solutions will certainly be preferable to exclusive ones. Notwithstanding the evident differences between the two poles, it is worth considering the successful balance struck by the *Antarctic Treaty* [3]. The Treaty developed categories of consultative and non-consultative States Parties, and did not differentiate between those with and without territorial claims. A lesson to be learned?

28.2.3 Security Aspects

From its inception, it was clear that the Arctic Council *"should not deal with matters related to military security"* [32]. This explicit foundation of the Arctic Council was most probably a reflex reaction to the fact that the Arctic Ocean had served for decades as a highly sensitive divide between the two Cold War blocs and the immediate need at the time was to establish foundational levels of cooperation for the Arctic.

Modernization of existing security strategies is on the agenda of all Arctic coastal States [10]. Although, tensions have remained low in the Arctic Ocean since the cold war – perhaps best demonstrated by the 2010 treaty between Norway and Russia to resolve their 40-year boundary dispute in the Barents Sea [30] – some observers have noted *"the initial stage of an Arctic military build-up"* [24]. It therefore seems legitimate to wonder which institution would be ideal to deal with aspects of security in the Arctic Ocean.

In early 2009, NATO dedicated a high-level meeting in Reykjavik, Iceland, to discuss this question [23]. The Chairman's conclusions [25] mention *"non-traditional threats such as risks to the environment",* and *"the need to preserve economic and energy security."* NATO was said *"to have legitimate security interests"* giving rise to *"a renewed NATO situational awareness in the High North."* The chairman's conclusions also noted that the *"participants agreed that strengthened cooperation between NATO and the Allies and Russia, within the existing frameworks, including the NATO-Russia Council when appropriate, is particularly important"*. The meeting ended with no truly operative outcome, perhaps largely due to the absence of authors from the Russian Federation. It is noteworthy that the NATO Advanced Research

Workshop at the University of Cambridge in 2010 involved Russian co-directorship, as further reflected by the co-editorship of this book, demonstrating the productive nature of inclusion in dialogues that relate to environmental security in the Arctic Ocean.

28.3 The Law of the Sea

Since the Arctic Ocean is a sea area, the international Law of the Sea applies. All Arctic States – with the exception of the United States of America – are states parties to the 1982 *United Nation Convention on the Law of the Sea.*

28.3.1 The Convention

The *United Nations Convention on the Law of the Sea* [36] is almost silent on issues regarding the Arctic Ocean. One provision under UNCLOS Part XII (Marine Environment), however, does deal with laws and regulations for vessels in ice-covered areas [29]. This provision under UNCLOS Article 234 has a clear link with Arctic sea conditions, although it does not explicitly mention the region:

> *Coastal States have the right to adopt and to enforce non-discriminatory laws and regulations for the prevention, reduction and control of marine pollution from vessels in ice-covered waters within the limits of the exclusive economic zone … Such laws and regulations shall have due regard to navigation and the protection and preservation of the marine environment based on the best available scientific evidence.*

If one considers the Arctic Ocean as an enclosed or semi-enclosed sea, UNCLOS Articles 122 and 123 would apply as well. These provisions call for widespread cooperation between States bordering these kinds of seas. The Arctic Council has not itself declared whether it deals with such a sea or not, nor is there consensus among scholars [28, 33] and practitioners on whether the Arctic Ocean is an enclosed or semi-enclosed sea. Coastal states belonging to the 'Arctic 5' might be more inclined to consider the Arctic Ocean as a semi-enclosed sea than other Arctic States.

28.3.2 Commission on the Limits of the Continental Shelf

One of the three main institutional bodies established under UNCLOS is currently dealing with an issue that is crucial to the Arctic region: the extension of certain sovereign rights over portions of the seabed that comprise outer continental shelves beyond 200 nautical miles. This body is the Commission on the Limits of the Continental Shelf (CLCS) set up under Article 76 and Annex II of UNCLOS.

The CLCS is fully operative and has received an extraordinary number of submissions regarding the establishment of outer limits of national continental shelves worldwide. The first submission concerned actually was with the Arctic Ocean in 2001 by the Russian Federation [12, 35]. Norway made a submission in 2006 and received positive recommendations in 2009 [13]. Iceland forwarded a submission in 2009 [14, 22] as did Denmark in 2009 [15, 40]. It is anticipated that Canada will forward its submission by 2013–2014. The United States is the only Arctic coastal state that has not signalled its intention to submit a proposal to the CLCS and this is because the United States has yet to ratify UNLCOS.

Deliberations and recommendations of the CLCS will determine which parts of the Arctic Ocean, or rather its seabed, remain part of the "Area" beyond sovereign jurisdictions and which parts will belong to extended national continental shelves. Preliminary indications are that the accumulated continental shelves of the coastal States will eventually cover most of the central Arctic Ocean, possibly leading to a *"nationalization of the Arctic Maritime Commons"* [28]. This could consequently reduce the applicability of the *"common heritage of mankind"* principle (UNCLOS Article 136). Up to now, the *"common heritage of mankind"* principle has formed another legitimation for the interest, if not to say entitlement, that Arctic outsiders have in taking part in the specific discussions.

28.3.3 Other Treaties

There are a considerable number of non-Arctic-specific treaties, mostly dealing with environmental issues, which will have impacts on the Arctic [39]. There are also a number of bilateral treaties or agreements between Arctic States and Arctic neighbours. Until recently, the only multi-partite, 'regional' international agreement for the Arctic was the 1973 *Agreement on the Conservation of Polar Bears*. Demonstrating significant progress, at the seventh ministerial meeting of the Arctic Council in May 2011, a search and rescue agreement for the Arctic was signed by all of the Arctic states [5].

28.3.4 United Nations General Assembly Resolution

The yearly resolution by the United Nations General Assembly [37] on *"Oceans and Law of the Sea,"* which has been ongoing since UNCLOS came into force in 1994, has to date mainly neglected Arctic issues. The 2010 resolution contains a sole preambular paragraph related to the vulnerability of the Arctic climate. Despite modest and recent attempts to fill this gap, consensus to repair this anomaly has not yet been achieved. It can well be argued that a number of recent developments in the Arctic Ocean, especially climate change, are of common global concern and thus would find a legitimate place in the relevant UNGA Resolution. The fact that Arctic Ocean issues – not identical but similar to Antarctic issues after 2006 [8] – do not currently make it into United Nations instruments demonstrates a firm reluctance on the part of key players to see multilateral institutions involved with the topic.

28.4 Conclusion

Much seems to indicate that the existing institutional structures are fragmentary, leaving room for amendment and improvement. This indication does not ignore the merit of the flexibility and adaptability of the way the existing structures of the Arctic Council are set up. The following could tentatively be put forward as areas in which improvements could be made:

- The Arctic Council could be further consolidated and institutionalised;
- The rules of procedure of rights and categories of members, permanent participants and observers to the Arctic Council could be re-thought in order to increase overall participation of qualified actors;
- UNCLOS could be complemented by an implementation agreement regarding environmental aspects of the Arctic Ocean;
- Appropriate steps could be taken by Arctic Council members to facilitate the contribution of expertise and inputs from qualified players from outside the "inner Arctic circle", in order to address the existing challenges in the region;
- Recent developments in the Arctic Ocean, especially climate change, are of common global concern and deserve mentioning in relevant UNGA resolution;
- The Arctic, especially its ocean, needs the best possible cooperation from all those interested and qualified to contribute.
- Arctic issues, climate change and environmental security are not "business as usual": they are matters of global importance.

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Chapter 29
Can Competent Authorities Cooperate for the Common Good: Towards a Collective Arrangement in the North-East Atlantic

David Johnson

Abstract The OSPAR Commission implements the regional seas convention for the North-East Atlantic and has been at the forefront of delivering the ecosystem approach through the development of robust measures to deal with marine pollution. For purposes of assessment the OSPAR Maritime Area is divided into five Regions, Region I representing 'Arctic Waters.' OSPAR Region I includes the transition between the Boreal and true Arctic biogeographic zones, incorporates the presence of the North Atlantic Current as well as the northward flowing Norwegian Coastal Current, and is characterised by seasonally high primary productivity and high natural variability. The starting point for a 'collaborative arrangement' between relevant competent authorities, with the aim of ensuring a highest level of conservation of selected areas in the North-East Atlantic beyond national jurisdiction, was explored at an informal Workshop in Madeira in March 2010. The Ministerial Meeting of OSPAR, held in Bergen in September 2010, agreed unprecedented protection of six extensive marine protected areas (MPAs) in Region V, on the Mid-Atlantic Ridge and isolated seamounts. Whilst being required to protect biodiversity, OSPAR does not have competence for those activities that are arguably the most likely to have the most impact in these remote areas, namely fisheries, international shipping and seabed mining. Most multilateral environmental agreements have adopted key principles that enshrine sustainable development and governance ideals. Regimes of this sort, designed to limit pressures and impacts of human activities, have elements in common with built in checks and balances designed to govern exploitation. By focussing on a defined geographic area and recognising the value of its natural capital, it has proven possible to scope complementary and mutually reinforcing management measures. OSPAR, the North-East Atlantic Fisheries Commission (NEAFC) [18]

D. Johnson (✉)
Executive Secretary, OSPAR Commission, Victoria House,
37–63 Southampton Row, London WC1B 4DA, UK
e-mail: david.johnson@ospar.org

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and the International Seabed Authority (ISA) have started to consider this in respect of one MPA – the Charlie Gibbs Fracture Zone. The intention is to broaden the discussion to include other competent authorities. A combined regime of this nature demands transparency and trust between competent authorities. It becomes incumbent on States in agreement within one competent authority to influence and work within other competent authorities. It also requires that States reach a common position internally between those dealing with different sectors within their administrations. Given that such a solution is unprecedented, there is merit in establishing a pilot case to focus the best scientific and legal minds. Ultimately, however, such a solution becomes a matter of political will and decision.

29.1 Introduction

The OSPAR Commission is the mechanism by which the contracting parties, fifteen States whose catchments feed into and/or maritime zones of responsibility fall within the North-East Atlantic, together with the European Commission, representing the European Union, collectively implement the OSPAR Convention [25].[1] This regional seas convention is a consensus-driven organisation whereby the contracting parties shall, in accordance with the provisions of the Convention, take all possible steps to prevent and eliminate pollution and shall take the 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 and, when practicable, restore marine areas which have been adversely affected.

As is common with other multilateral environmental agreements, the OSPAR Commission has moved on from looking at consequences of marginal changes to input factors, to embracing a more holistic 'ecosystem approach' which takes certain values as being predominant and does not wish to compromise them. This remains consistent with an obligation to apply the precautionary principle, the "polluter pays" principle, best available technology and best environmental practice. To achieve its objectives the OSPAR Commission can adopt legally binding decisions in addition to recommendations and other agreements (such as voluntary guidance). Contracting Parties are obliged to report on the implementation of these measures. Furthermore, the rules of procedure make provision for participation of Observer organizations (industry representatives, environmental non-governmental organizations and international partner organisations) and establish rights of public access to information.

On this basis, the role of the OSPAR Commission is to affect a balance between different national and international interests: between States' freedom to use the seas and to exploit their sovereign rights versus being good neighbours; and between

[1] The OSPAR Convention [25], which entered into force in 1998, consolidated the 1972 *Oslo* Convention [20] to control pollution from dumping and the *Paris* Convention [26] to control pollution from land-based sources with a mechanism to add further Annexes.

intra-societal and intergenerational equities. At the same time it is important to achieve pragmatic politically acceptable outcomes whilst taking due account of aspirational goals for a physical, chemical and biological environment consistent with a high level of protection. Importantly, within the OSPAR Commission, this is taken forward on a 'lead country' basis with due consideration of the limits of scientific knowledge concerning critical processes for maintaining structure and functioning of ecosystems including interactions both within food-webs (multi-species approach) and with the background. Furthermore, all OSPAR Contracting Parties have a joint responsibility for the whole OSPAR Maritime Area including those areas beyond their national jurisdiction.

In 1994, for the purposes of monitoring and assessment, the OSPAR Maritime Area was divided into five Regions namely Arctic Waters, Greater North Sea, Celtic Seas, Bay of Biscay and Iberian Coast, and the Wider Atlantic. This division recognizes that bathymetry of the seabed and ocean circulation exert strong control on the ecosystems of the North-East Atlantic. However, the OSPAR Regions were established with regard to administrative and political boundaries as well as biogeographic zones and this has created some anomalies. OSPAR Region I (Fig. 29.1), Arctic Waters, includes the transition between the Boreal and true Arctic biogeographic zones, incorporating the presence of the North Atlantic Current as well as the northward flowing Norwegian Coastal Current. Spring melting of seasonal sea ice strongly influences primary productivity supporting large stocks of fish, marine mammals and seabirds. However, fish stocks are subject to highly variable recruitment and many species are near the edge of their distribution range.

29.2 Establishing 'Quality Status' as the Basis for Collaboration

A core strength of the OSPAR Commission is monitoring and assessment of the marine environment. This has been achieved through a detailed negotiated Joint Assessment And Monitoring Programme (JAMP). The JAMP plans for individual assessments of pressures such as noise or specific human activities such as dumped munitions; annual monitoring reports on main concerns such as radioactive substances and eutrophication; and a final holistic overview Quality Status Report (QSR) covering a fixed period of years. The aim of the QSRs is to summarise available knowledge, identify gaps, assess progress against agreed strategies and provide a scientific platform as a basis for future efforts. Efforts have been made in QSRs conducted in 2000 and 2010 to create regional summaries.

Globally, one could argue that impacts of disposal options and pollution pathways have been a priority over the past 30 years for which successes can be claimed. Exploitation impacts are now a major concern. In future climate change and ocean acidification impacts are predicted to eclipse all else. The QSR 2000 [21] highlighted concerns about persistent organic pollutants in fish and mammals, impacts of fishing and fish farming and uncertainties about the impacts of climate change.

Fig. 29.1 OSPAR Maritime Area and the five OSPAR regions in the North-East Atlantic, which includes the Arctic Ocean (Region 1)

The QSR 2010 [24], a decadal summary of monitoring and assessment for the North-East Atlantic, notes strong changes in Region I with high confidence of increases in sea-ice loss, sea temperature rise and acidification. More information is needed to confirm range shifts of fish species and food web changes, but there is little doubt these are underway. The QSR 2010 recommends keeping atmospheric inputs of nitrogen and long-range air transport of hazardous substances under review and notes the likelihood of increasing pressure on the marine ecosystem from future oil and gas extraction, shipping and marine tourism. More integrated management plans, close monitoring and international cooperation are encouraged.

Such conclusions are drawn from the work of the Intergovernmental Panel on Climate Change and detailed studies (e.g., [2, 28]). Declines in seabird populations are a significant concern and more information is needed to confirm range shifts of fish species and food web changes. The Census of Marine Life highlighted the Barents Sea as an area subject to rapid change where investment in expanded time-series sampling programmes and new Arctic observatories, that could monitor changes in real time and from afar, are needed [27].

Whilst chemical contamination overall is less than in other OSPAR Regions, concentrations of PAHs and PCBs are still unacceptable. The QSR 2010 recommends keeping atmospheric inputs of nitrogen and long-range air transport of hazardous substances under review. Large new extraction projects, such as the Shtokman field in the Barents Sea are indicative of increasing pressure to the marine ecosystem from future oil and gas extraction, compounded by increased shipping and marine tourism activity. Detailed Arctic Council reports underpin these headline conclusions. For example, AMAP [1] highlighted key characteristics of the Arctic relevant to oil and gas activities, their effects and suggested work needed to fill information and knowledge gaps. More integrated management plans, close monitoring and international cooperation are encouraged.

It can be concluded that the marine environment of OSPAR Region I (and indeed the Arctic as a whole) faces a prospective compound triple threat. Firstly, long-range transportation of pollutants, a legacy of actions now regulated at source and improving in other OSPAR Regions, means that pressures are increasing in the Arctic. AMAP [3] provides more detail, for example on legacy persistent organic pollutants. Secondly, melting sea ice, resource depletion elsewhere and technological advances making Arctic resources accessible, now opens the door for exploitation and the environmental risks that entails. Finally, Arctic Waters will suffer a disproportionate impact of ocean acidification. Calculated aragonite saturation state in terms of excess carbonate ion concentration suggests significant areas of the North-East Atlantic will be corrosive to calcifying organisms by 2100 [19]. Experiments off Svalbard (Norway) confirm that cold polar waters dissolve gases more quickly with projections of an under-saturated Arctic as early as 2050. Several studies (e.g. [13]) have expressed concern about the adequacy of protection regimes given this scenario, prompting calls to treat the central Arctic as international space [6].

29.3 Progress Towards Establishing a Regime for the Wider Atlantic

A model for international cooperation in Region I could readily draw on current work in OSPAR Region V (the wider Atlantic), where, as in parts of Region I, the regime is dominated by the High Seas. Within Region I, the so-called ‘Banana Hole’ in the Norwegian Sea and the so-called ‘Loop Hole’ in the Barents Sea are both High Seas enclaves (Fig. 29.2). Furthermore, as in the Arctic, key areas are also subject to submissions by coastal States to the Commission on the Limits of the Continental Shelf.

The Ministerial Meeting of OSPAR, held in Bergen in September 2010, agreed unprecedented protection of six extensive marine protected areas (MPAs) in

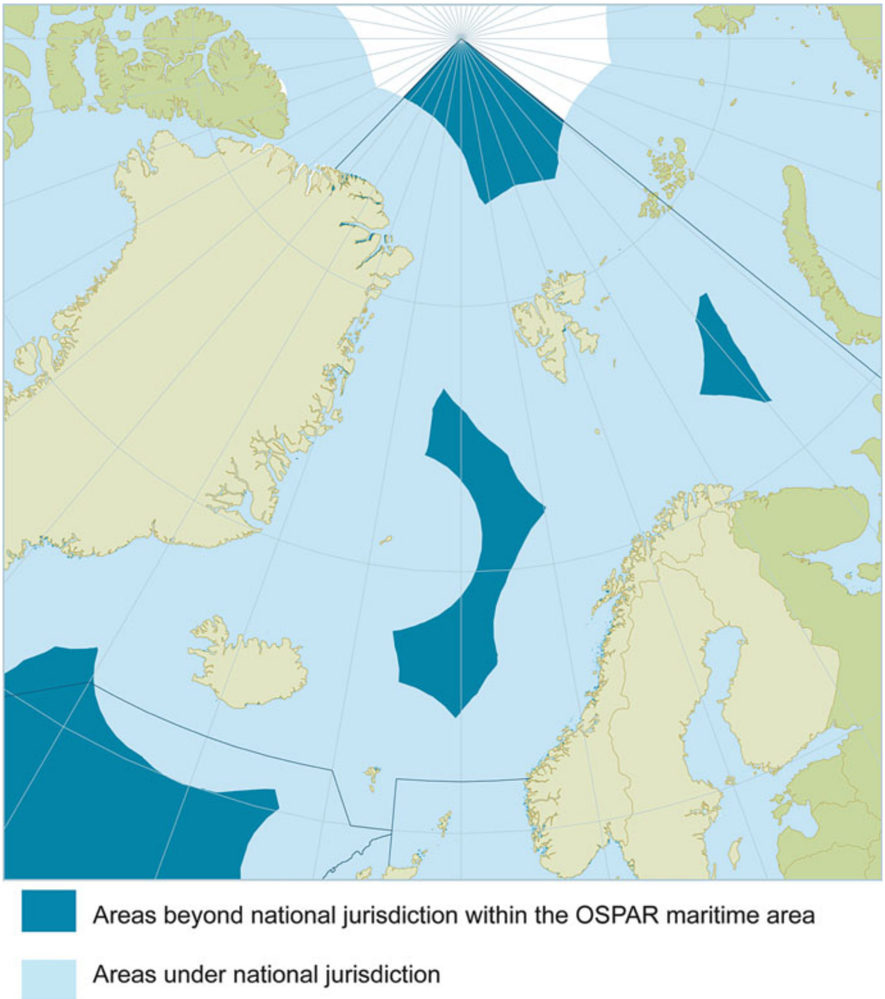

Fig. 29.2 Areas beyond national jurisdiction within OSPAR Region I

Region V, on the Mid-Atlantic Ridge and isolated seamounts (see Fig. 29.3). This response to the United Nations General Assembly call for protection of vulnerable marine biodiversity and ecosystems has made use of the OSPAR list of threatened or declining species and habitats [22] to justify those areas in need of protection. OSPAR established a clear scientific rationale and conservation objectives for these MPAs, however, the process of designation was legally and politically fraught. Despite a requirement to protect biodiversity, OSPAR does not have competence for those activities that are arguably the most likely to have the most impact in these remote areas, namely fisheries, international shipping and seabed mining.

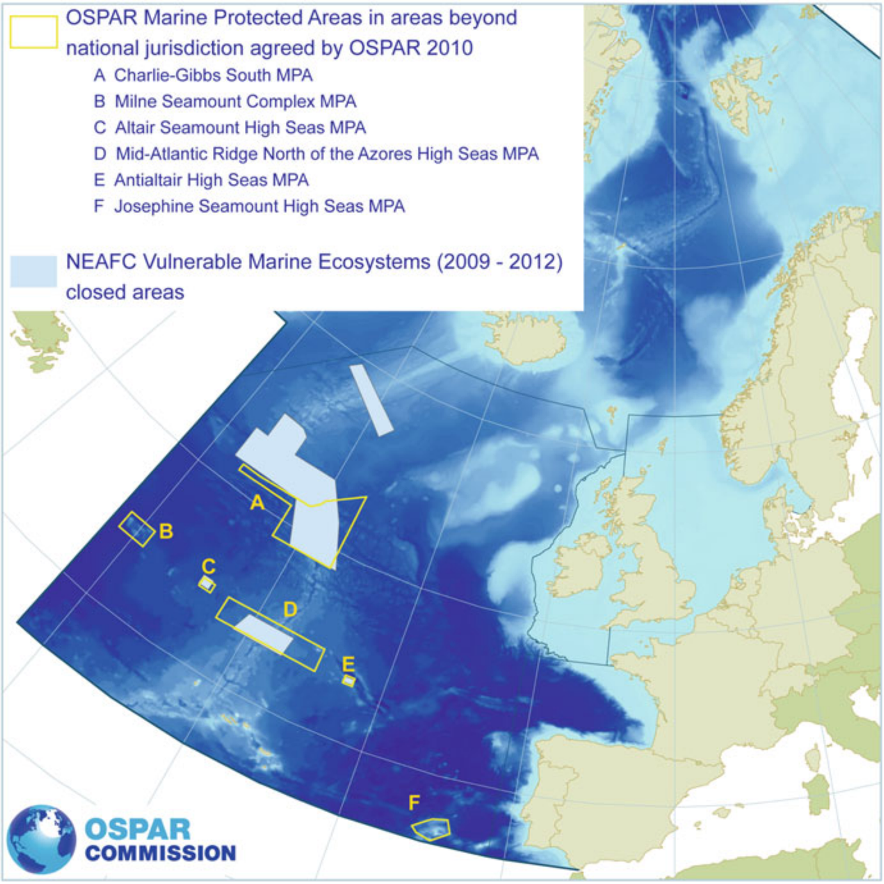

Fig. 29.3 Marine protected areas beyond national jurisdictions agreed by OSPAR [24] and closed areas in vulnerable marine ecosystems agreed by NEAFC [17] in the North-East Atlantic, including the Arctic Ocean

More information is therefore still needed to substantiate the most pressing future concerns for elements of these deep-sea ecosystems in need of protection. Many of the species involved are slow growing, far-ranging and often little understood. Many of the ecosystem processes are difficult to monitor and assess. Human activities have the potential to leave a lasting footprint and to destroy biological resources in environments where rarity is common with new species and new life cycles the subject of recent astounding discoveries [7].

Designation refuted any doubt that the OSPAR Commission can establish High Seas MPAs in respect of its own Contracting Parties. However, the establishment of bottom fishing closures by the North-East Atlantic Fisheries Commission (NEAFC) in 2009, in broadly the same areas, for the protection of cold water corals and other vulnerable marine ecosystems, was instrumental in reassuring fisheries interests about the efficacy of such designations. In addition, OSPAR Commission Contracting Parties now need to actively seek to raise awareness and solicit the voluntary cooperation of other non-OSPAR Commission Parties.

29.4 Bringing Together Relevant Competent Authorities

Over the past 3 years the OSPAR Commission has sought to formalise working arrangements with other international organisations. A longstanding Agreement of Cooperation between OSPAR and the International Maritime Organisation (IMO) has facilitated exchange between the two organisations and development of regional actions such as voluntary D1 Ballast Water Exchange Guidance [23]. In 2008 and 2010 respectively, NEAFC and the International Seabed Authority (ISA) signed a Memorandum of Understanding with the OSPAR Commission [16]. All competent authorities concerned are bound by the international legal framework for regulating activities in areas beyond national jurisdiction provided by the *United Nations Convention on the Law of the Sea* [29].[2]

In 2009 the OSPAR Commission agreed on the terms of reference for an informal meeting with stakeholders to be held as part of the roadmap for further work on the then proposed OSPAR MPA in the Charlie-Gibbs Fracture Zone.[3] Given that the management of human activities in the High Seas of the North-East Atlantic falls under the competences of a number of international organisations and Conventions, and in order to move from a sectoral to an integrated ecosystem-based approach, the meeting [16] concluded that a 'collaborative arrangement' for areas identified by individual Competent Authorities was needed. This was on the understanding that the scientific evidence confirming the value and vulnerability of the biodiversity within these areas, in all OSPAR Regions, was accepted by all.

The meeting developed a draft 'collaborative arrangement' of competent authorities towards encouraging mutual notification, consultation and cooperation that included:

(a) generic management measures;
(b) specific management measures in relation to specific areas proposed by OSPAR; and
(c) a set of draft Joint Principles of Competent Authorities on the management of human activities in selected areas in ABNJ within the OSPAR Maritime Area.

It was agreed that the draft principles were enshrined in existing international maritime and environmental legislation, including NEAFC, OSPAR and UNCLOS

[2] Respective competences are set out in OSPAR Publication (09/22/1-E, Annex 6).

[3] This informal meeting [16] with stakeholders was hosted by Portugal in Funchal (Madeira) from 23 to 25 March 2010 and was attended by representatives of OSPAR, NEAFC, the International Seabed Authority, the International Whaling Commission and the International Union for Nature Conservation (IUCN).

as well as the *Code of Conduct for Responsible Fisheries* from the Food and Agriculture Organization of the United Nations [10], ISA *Regulations on Prospecting and Exploration for Polymetallic Nodules in the Area* ("Mining Code;" [12]); and the *International Convention for the Prevention of Pollution from Ships, 1973, as Modified by the Protocol of 1978 Relating Thereto* [15]. Also relevant European Union legislation and policies include these principles, particularly the *Marine Strategy Framework Directive* [9] and the *Common Fisheries Policy* [8]. Thus they provide the context to more specific management measures.

The meeting further emphasised the importance of ensuring information exchange on this envisaged cooperation within the administrations of OSPAR Contracting Parties, and the need to promote consistent positions of OSPAR Contracting Parties within the different Competent Authorities. It was also made clear that such an arrangement was not intended as a legal instrument. The 2010 meeting of the OSPAR Commission agreed to further explore these ideas and a second informal meeting was held in 2012.

29.5 Conclusion

Within Region I, in addition to those competent authorities involved with the wider Atlantic, the OSPAR Commission is initiating closer links with the Arctic Council given the Council's key collaborative contribution to Arctic research and governance. The OSPAR Convention does include provision for dispute settlement (albeit very rarely used) but its main contribution could be to build bridges at the core of an institutional alliance of existing competent authorities in line with the sentiments of the *Ilulissat Declaration* [11].

A combined regime of this nature demands transparency and trust between competent authorities. It becomes incumbent on States in agreement within one competent authority to influence and work within other competent authorities. It also requires that States reach a common position within their administrations, internally between those dealing with different sectors. The Arctic Council Working Groups, particularly PAME and AMAP, already articulate well with relevant competent authorities. For example, there are strong links between PAME and the International Maritime Organisation in the context of the Arctic Marine Shipping Assessment [4].

Given that such a solution is unprecedented there is merit in establishing a pilot case to focus the best scientific and legal minds. In 2008 the European Union funded the Arctic TRANSFORM project to identify regulatory gaps between different sectoral governance regimes as well as many gaps within such regimes [5, 14]. The OSPAR Convention area only covers the Atlantic sector of the Arctic marine area but is perhaps best placed at the current time, given recent multilateral negotiations, to test this policy option and evaluate its potential as a governance model for other portions of the Arctic.

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Chapter 30
Cooperation Across Boundaries in the Arctic Ocean: The Legal Framework and the Development of Policies*

Rolf Einar Fife

Abstract The effects of global climate change for the Arctic Ocean are momentous. New aspirations arise in light of global needs for resources and transport routes. This has mobilized calls for political vision and innovation, in order to provide for timely measures to protect the environment and the livelihoods of indigenous and other people. Warnings about looming conflict or confrontation in the Arctic Ocean have also been issued. However, the latter have not been grounded in a thorough analysis of the existing legal framework and the scope and depth of on-going cooperation by coastal States in that area. Nor have calls for new legal frameworks drawn on a clear understanding of the role and potentialities of the comprehensive legal framework already applicable to the Arctic Ocean. Legal analysis is necessary in a complex, globalized world also in order to formulate effective policies. The focus of the article is on the existing legal framework and its possibilities. The international law of the sea has a particularly practical import for the identification and timely adoption of measures to resolve concrete issues and promote international cooperation across boundaries. The role and interplay of various institutions will also be illustrated. This includes the key policy role in several contexts of the Arctic Council, which is the high level forum for cooperation in the Arctic.

*Hon. Rolf Einar Fife's own background is that of a government lawyer and diplomat of one of the coastal States surrounding the central Arctic Ocean. While the article draws upon examples from the development of national legislation and international rules, policy formulation, negotiations and other activities related to oceans affairs, it does not constitute a statement of the views of the Government of Norway and the author remains solely responsible for it.

R.E. Fife (✉)
Legal Department, Ministry of Foreign Affairs, 7. Juni-plassen/Victoria Terrasse,
PB 8114 Dep, Oslo N-0032, Norway
e-mail: ref@mfa.no

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30.1 An Overview

The effects of global climate change in the Arctic region are momentous. They are vividly visualized by the rapidly receding sea ice in the Arctic Ocean and have led to alarming conjectures about the ensuing changes to the ecosystems. New aspirations arise in light of global needs for resources and transport routes. This has mobilized calls for political vision and innovation, in order to provide for timely measures to protect the environment and the livelihoods of indigenous and other people. Warnings about looming conflict or confrontation in the Arctic Ocean have also been issued ([8, 22]; versus a considerably more nuanced [36]). Not all such warnings have been grounded in a keen analysis of the existing legal framework and the scope and depth of on-going cooperation by coastal States in that area. Nor have calls for new legal frameworks and governance mechanisms always drawn upon a clear understanding of the role and potentialities of the comprehensive legal framework already applicable to the Arctic, as notably presented in 2006 by the former Under-Secretary General for Legal Affairs of the United Nations, Hans Corell [12, 13].

Legal analysis is necessary in a complex, globalized world also in order to formulate effective policies. In the following, the focus is put on the Arctic Ocean, not on the Arctic region at large. It is seen through the prism of the existing legal framework and its possibilities. The international law of the sea provides for such a legal framework, as primarily contained and reflected in The *United Nations Convention on the Law of the Sea* or UNCLOS [40]. Rather than providing an overview of a considerable academic literature, the perspective will be on the practical import of this legal framework for the development of policies, including the identification and timely adoption of practical measures to meet future challenges (following up on [15]). The emphasis will be on the resolution of concrete issues, including the clarification of maritime boundaries and the scope for international cooperation across boundaries. The role and interplay of institutions will also be illustrated. This includes the key policy role in several contexts of the Arctic Council, which is the high level forum for cooperation in the Arctic. It was established in 1996 and groups the eight Arctic States Canada, Denmark/Greenland, Finland, Iceland, Norway, Russia, Sweden and the United States, as well as Permanent Participants including representatives of indigenous people [9].

As suggested in the international discussion engaged by historical researchers in a colloquium hosted by the Scott Polar Research Institute of the University of Cambridge [23], there is also a need to approach studies about the high north in a critical and self-reflective spirit. Individual actors' own Arctic activities and experience should also be appropriately contextualized.

30.2 A Brief Reminder of the Changes in the Arctic Ocean and Their Specificity

Key causes of global climate change do not lie in the Arctic itself. Nor do their solution or mitigation, or only to a limited degree. Nevertheless, the Arctic provides privileged vantage-points for global climate studies. The Arctic Council has already contributed unique scientific input documenting the need for global climate action [1].

Climate change impacts not only the Arctic Ocean, but also the broader Arctic region, including other Arctic waters. Nevertheless, alleged controversies have specifically been linked to the central Arctic Ocean. This may have to do with the opening up of hitherto largely inaccessible maritime areas and sea routes, and future challenges for ecosystems and the survival of species such as polar bears. However, they may have, not least, to do with speculations as to a race or "grab" for resources in the area. This was exemplified by Borgerson [8] after the spectacular technological feat of planting a Russian flag on the seabed at the North Pole in August 2007. While questions about confrontations have been persuasively answered in the negative, imaginations and passions have been mobilized, including as regards new possibilities and challenges of new transportation routes and human activities in the Central Arctic Ocean. Moreover, mapping of the extent of the continental shelf by coastal States, within the deadlines set by the UNCLOS, has rightly been understood also by broader audiences as a phenomenon related to compliance with the international rule of law, rather than any alleged new 'great game.'

Even allowing for huge periodic variations beyond the seasonal ones, the ongoing changes in the sea ice are momentous. Satellite imagery has repeatedly shown ever larger chunks of sea ice breaking up and accelerating patterns calling into question all previous mathematical models and projections for ice conditions. Major alterations in seasonal ice bear a higher incidence of unpredictable drift ice, while also opening up possible new sea routes. These could dramatically cut transportation time for essential trade, thus also reducing related carbon emissions into the atmosphere. New energy sources may furthermore become more accessible, thus contributing to security of vital energy supplies. At the same time, the spectres of 1912 *'Titanic'* or 1989 *'Exxon Valdez'* accidents, or of oil spills as in the Gulf of Mexico in April 2010, have been raised. The above challenges, including search and rescue and other practical as well as resource consuming issues, are of the most direct concern to the coastal States and their coastal communities. At the same time, there is a legitimate demand for more information on how governments are addressing new challenges and opportunities. A specific focus has in this regard been put on the central Arctic Ocean, since the presence of ice has hitherto largely limited human access to this ocean space. It has therefore also largely hindered the implementation of a number of international legal rules and principles already applicable to these waters. While a comprehensive legal framework exists, there is a need to put it fully into effect when new human activities are being envisaged.

30.3 Conceptions of the Arctic Ocean. The Utility of Definitions in This Context

At the outset, there exists no unique set of conventions nor any universally applicable legal definition as to when to use the various geographical terms “Arctic”, “Arctic waters” or “Arctic Ocean”. This is exemplified by the pragmatic variety of definitions used by individual Arctic States and the Arctic Council itself when considering particular topics. In general, this may also arguably reflect insights provided by the philosophy of language of the later Wittgenstein [41] as to the possible explanation of the meaning of a word as its use in the language. Concepts often reflect concrete needs in a given context for a given purpose.

An example is provided by different definitions of the Arctic given in the Arctic Council *Offshore Oil and Gas Guidelines* [2, 3]. Finland defined its areas north of the Arctic Circle as being, for these purposes, Arctic, while the whole of Iceland was defined by Iceland to be within the Arctic area, even though Iceland with few exceptions is situated south of the Arctic Circle.

Nevertheless, it is useful to refer with some degree of precision to the specific maritime area surrounding the North Pole, in Norwegian incidentally referred to as “Polhavet”, as distinguished from adjacent seas or other oceans. Other maritime areas are already to a large extent the object of concrete regulations. The same has not applied to the circumpolar maritime area which includes and is enclosed by the 200-mile zones of five coastal States. These are Canada, Denmark/Greenland, Norway, the Russian Federation and the United States of America. Access to the central part of this ocean requires navigation through one or more of their zones or territorial seas.

The areas surrounding the North Pole are ice-covered waters characterized by a deep seabed – and major sea currents govern the movement of its ice. This was proven by the Norwegian polar explorer Fridtjof Nansen with the *‘Fram’* expedition 1893–1896. In the grip of drifting sea ice for 3 years, the vessel *‘Fram’* crossed a significant part of the Arctic Ocean. In so doing, it also confirmed a theory to this effect previously launched by Professor Henrik Mohn [24] [37], whose name was subsequently lent to the part of the Mid-Atlantic spreading ridge northeast of the island of Jan Mayen, the *Mohns ridge.*

The International Hydrographic Organization has indicated a precise definition of the central “Arctic Ocean” [17]. This definition has no bearing on any political or legal considerations, but provides a practical geographical designation. Whether one then uses the expressions Arctic Ocean, Arctic Ocean proper or Central Arctic Ocean to designate this maritime area is, in legal terms, secondary, although uniform terminology may nevertheless be useful, particularly for mariners. In the central Arctic Ocean, the presence of ice covering the area for most of the year has created obstructions to navigation and other human activities, and has therefore also hindered the implementation of a number of legal rules. When referring to the Arctic Ocean, the focus in the following will thus be on this maritime area.

30.4 The System of the *United Nations Convention on the Law of the Sea*

The international law of the sea provides a general legal framework applicable to the Arctic Ocean. The *United Nations Convention on the Law of the Sea* [40] also largely reflects to current international customary law that is already binding on all States [7, 34]. It establishes, with due regard for the sovereignty of all States, a legal order that promotes international peace and security. Carefully balancing a large number of key interests, it does so by setting out a basic legal framework which ensures clarity and predictability with regard to high seas freedoms, including of navigation, but also coastal State rights, duties and responsibilities, as well as a number of other interests.

Most of world trade and transports of goods, communication of massive amounts of data through fibre optic submarine cables, liberty of movement of navies and the development of effective policies to counter illegal, unregulated or unreported fisheries are among the activities that depend on this legal framework. The maintenance of international peace and security would not be served by upsetting the latter. This is also why the system of the Convention is firmly and fundamentally embedded in the international legal order. Article 311 of the Convention requires that all other, earlier or subsequent, agreements be compatible with its system.

The clarification of limits of national jurisdiction and maritime boundaries are also building-blocks of international peace and security, and for responsible and sustainable uses of the seas. Jurisdictional clarity and predictability promote international stability, but also the development of environmental protection and long-term investments. Outer limits of national jurisdiction and maritime boundaries between States are not separation barriers. They provide legal clarity that may promote effective national policies and international cooperation.

While the coastal States have particular responsibilities for ocean space management in areas under their jurisdiction, also other States have rights, duties and responsibilities related to the uses of high seas freedoms and the international seabed area beyond national jurisdiction. Because of the presence of polar ice, institutional mechanisms and regulatory possibilities have up to now not been fully implemented in the Arctic Ocean.

The Convention and its derived system provide a comprehensive legal framework for addressing key challenges also in this field. However, the distinction between a legal framework and actual regulations is often overlooked or misunderstood. The Convention provides scope for the formulation of effective policies and regulatory measures to be taken at the national or international levels, as long as certain ‘rules of the game’ are followed. Examples include the adoption by the International Maritime Organization (IMO) of mandatory sea routing measures or standards for the design of ships and operating procedures for navigation in ice-covered waters. Such mandatory regulations can be supplemented by action taken by port State authorities. To be effective, measures in this field actually need to mobilize the unique legally binding force and legitimacy that the international law of the sea can muster. To realize this potential, political priorities must at the same time be geared to focus on effective measures. In this context, the Arctic Council may play a key role as regards agenda setting for action in the relevant bodies, including the IMO.

As regards cooperative frameworks, institutional innovation based on existing legal possibilities need to be fully analyzed. These issues have led to interactions among the five coastal States surrounding the central Arctic Ocean, policy formulation under the auspices of the Arctic Council and action to be taken at the national levels and within the competent international organizations.

30.5 Implementation of the UNCLOS System in the Arctic Ocean

As expressed in its Preamble, an important purpose of the Convention was to settle *"all issues relating to the law of the sea."* Moreover, it recognized as desirable to establish through this Convention (Preamble):

> *with due regard for the sovereignty of all States, a legal order for the seas and oceans which will facilitate international communication, and will promote the peaceful uses of the seas and oceans, the equitable and efficient utilization of their resources, the conservation of their living resources, and the study, protection and preservation of the marine environment.*

In keeping with the finality and ambition of this basic legal framework, the Convention contains express provisions on the relation to any other, earlier or subsequent, conventions or other international agreements. Its Article 311 underlines requirements of compatibility of such agreements with this Convention.

There has been some academic debate as to whether the Arctic Ocean proper constitutes a semi-enclosed sea, within the meaning of Part IX of the Convention (Articles 122 and 123), which may depend on how the Arctic Ocean is measured [35]. This question has, however, no bearing on rights, duties, responsibilities and freedoms under the Convention. Part IX encourages coordination and cooperation between the States bordering such a sea. Coordination and cooperation, particularly between neighbouring coastal States, has taken place in various maritime areas irrespective of whether Part IX is applicable or not. A key requirement is, in any case, respect for the rules contained in other parts of the Convention.

A topical example of cooperation between Arctic neighbouring States is based on the fisheries agreements between Norway and Soviet Union Russia [29, 30]. One of its key features is the regulation of fish stocks in the Barents Sea on the basis of the total area of distribution of these stocks, with considerable flexibility as to geographical access for fishermen in maritime areas under the parties' jurisdiction.

Coastal States have particular rights, obligations and responsibilities in their maritime zones and on their continental shelves, while other States have freedoms and rights in conformity with the Convention. Moreover, the latter provides in Article 234 for specific measures that may be adopted by coastal States in ice-covered waters. Among specific duties of coastal States is the promotion of the establishment of search and rescue systems (UNCLOS Article 98 and [16]). There is scope for considering the rights under this article in the economic zone also in light of the particular obligations under Article 98(2) of the Convention, as part of a broader ‘risk management’ system [6].

Referring to the Convention system requires also the consideration of other legal instruments derived from UNCLOS. A significant addition concerns fisheries on the high seas, in areas beyond 200-mile zones of coastal States. The Straddling Stocks Agreement [38] refers in its Article 6(7) to the need to take precautionary measures when natural phenomena may impact stocks. Such phenomena may include climate change. The agreement also refers to the need for particular data collection in the presence of environmental factors in its Annex I Article 3(2)(c). This provides an important framework for the timely identification of measures, including by coastal States, in order to promote a precautionary approach that may ensure compatibility between measures established for the high seas and those adopted for areas under national jurisdiction, in conformity with Article 7 of the Agreement.

In order to analyze particular issues requiring cooperative measures by the coastal States, the Norway took the initiative to convene in October 2007 the legal advisers and other senior officials of the foreign ministries of the five coastal States littoral to the Arctic Ocean, in order to consider the applicable legal framework. The discussions showed broad agreement on the applicability of a comprehensive legal framework constituted notably by the international law of the sea and the need for further implementation and cooperation within this framework [26]:

> *At the invitation of the Norwegian Government, representatives of the five coastal States of the Arctic Ocean – Canada, Denmark, Norway, the Russian Federation and the United States of America – met at the level of senior officials on 15 and 16 October 2007 in Oslo, Norway, to hold informal discussions.*
>
> *The participants noted recent scientific data indicating that the Arctic Ocean stands at the threshold of significant changes, in particular the impact of melting ice on vulnerable ecosystems, livelihoods of local inhabitants, and potential exploitation of natural resources.*
>
> *In this regard, they recalled the applicability of an extensive international legal framework to the Arctic Ocean, including notably the law of the sea. They discussed in particular application and national implementation of the law of the sea in relation to protection of the marine environment, freedom of navigation, marine scientific research and the establishment of the outer limits of their respective continental shelves. They discussed cooperative efforts on these and other topics. They also emphasized the commitment of their States to continue cooperation among themselves and with other interested States, including on scientific research.*

Building on these findings, Denmark and Greenland convened in 2008 representatives of the five coastal States bordering the Arctic Ocean at the political levels. A Declaration was issued on 28 May 2008 in Greenland. This *Ilulissat Declaration* [18] highlights not only the extensive international legal framework applicable to the Arctic Ocean and unique rights, duties and responsibilities of the five coastal States to implement appropriate measures. It also underlined the need to take steps in accordance with international law with other interested parties to ensure the protection and preservation of the fragile marine environment of the Arctic Ocean. In this context, particular priorities related to search and rescue capacities, scientific cooperation and protection of the marine environment were also identified – including through the International Maritime Organization. The key role of the Arctic Council was moreover stressed.

30.6 Application of Legal Frameworks to the Development of Policies in the Arctic Ocean

The existence of a legal framework cannot substitute for timely formulation of policies and the adoption of appropriate measures. An extensive international legal framework does apply also to the central Arctic Ocean – with or without sea ice. The challenge is to take timely measures – something that in turn requires effective implementation of the ground rules, the adoption of regulations and the formulation of appropriate policies. The *Ilulissat Declaration* may, in this regard, also be seen as a commitment to a significant programme of work.

Increased transparency and cooperation among the five neighbouring coastal States, particularly as regards mapping of the outer limits of the continental shelf in the Arctic Ocean, is undoubtedly useful to the implementation of applicable legal rules in this area. Significantly, it appears also to have led to an effective rebuttal against speculations about looming confrontations in the area. It is these States and their populations that are also the most directly affected by the impact of climate induced change in these waters. These States have certain responsibilities in areas under their jurisdiction, to be exercised in accordance with the rule of law, ensuring transparent, democratic and accountable national legislative processes and compliance mechanisms. Such national responsibilities are fully compatible with the recognition that these States also depend on close cooperation with other States in a number of other fields in accordance with international law and that other States may have legitimate interests, *inter alia* related to the exercise of high seas freedoms. Moreover, the exercise of these responsibilities is not contrary to an active support for the unique role of the Arctic Council (see below).

Among the high seas freedoms is the freedom of navigation for foreign vessels beyond the territorial sea of coastal States, which may have a maximum breadth of 12 nautical miles (roughly 22 km) measured from the baselines. This freedom is one of the enabling building-blocks for world trade as well as international peace and security, in addition for instance to the freedoms of overflight and the freedom to lay and operate submarine cables, which today is also essential for computer data communications and the world economy. These freedoms are binding on all States, as part of customary international law reflected and codified in UNCLOS. These high seas freedoms may not be restricted by other States, unless as provided for by the Convention or instruments compatible with the latter. It is therefore important to realize the existence of and the potential for further requirements and measures to counter risks and hazards presented by vessels and new sea routes, either for the marine environment or for safety of life at sea. The UNCLOS enables the International Maritime Organization (IMO) to adopt or give clearance to such requirements and measures. Only three categories of measures will be exemplified here.

Navigation may locally be channelled through particular sea lanes and vessel trafficking systems. An example of a mandatory sea routing system and traffic separation scheme for shipping in difficult Arctic climate conditions is provided for outside of the northern coast of Mainland Norway from Vardø to Røst, based on agreement between Norway and Russia and as adopted by the IMO [20]. Secondly, the IMO has the power to adopt binding global standards and requirements for ship structures, certification and operational requirements. It recommended *Guidelines for Ships Operating in Arctic Ice-Covered Waters* [19], which were later up-dated to include both polar regions [21]. The IMO is currently working on a mandatory polar shipping code. Thirdly, the IMO may establish special protection measures in areas vulnerable to damage by international maritime activities, through the identification of Particularly Sensitive Sea Areas or the designation of special areas. In all these cases, it is UNCLOS that enables the adoption of globally binding measures, through cooperative action with universal representation at the IMO.

In other contexts, the formulation and development of effective policies depends on the legal clarity and predictability that follows from the establishment of outer limits of national jurisdiction and bilateral delimitation between States, again in conformity with UNCLOS. Coastal States have to agree on outstanding boundaries between their continental shelves and maritime zones established under the law of the sea, on the basis of negotiations, unless dispute settlement procedures are used. Progress has been made concerning the establishment of maritime boundaries, including through important contributions of the International Court of Justice. As regards the central Arctic Ocean reference is made to the signature on 15 September 2010 by Norway and Russian Federation [28] of a treaty of maritime delimitation and cooperation in the Barents Sea and the Arctic Ocean. It sets out a maritime boundary of 1,700 km up to the outer limits of the continental shelf in the Arctic Ocean. It carefully maintains the significant fisheries cooperation between Norway and Russia in the Barents Sea, which has been uniquely successful in promoting sustainable fisheries of important straddling fish stocks. Moreover, it sets out modern mechanisms for cooperation with regard to any transboundary petroleum resources, on the basis of consideration of such deposits as single units and the appointment of a single operator. The Treaty reflects the priority given to resolution of outstanding overlapping national claims in the 2008 *Ilulissat Declaration* issued by the five coastal States around the Central Arctic Ocean. Another notable example of complex resolution of outstanding maritime delimitation issues was reached, further south, in 2006 for an area between Denmark/The Faroes, Iceland and mainland Norway as well as the Norwegian island of Jan Mayen. These Agreed Minutes with regard to delimitation of the continental shelf beyond 200 nautical miles have also to be seen against the background of processes engaged before the international Commission on the Limits of the Continental Shelf [10].

UNCLOS sets out in detail the rules governing the establishment of the outer limits of the continental shelf, with deadlines for the submission of scientific evidence before the CLCS. The latter has been considering documentation put forward by the Russian Federation and Norway for areas in the central Arctic Ocean. The Commission issued its final recommendations for Norway in 2009.

Beyond the continental shelf, the International Seabed Authority will have an important role to play in the Arctic Ocean, through its regulation of mining in the international seabed area beyond the continental shelves (the Area). The Authority ensures in accordance with UNCLOS universal participation of all its States Parties. The mineral resources of the Area are the *"common heritage of mankind"* –in the Arctic, as elsewhere.

As regards fisheries on the high seas beyond areas of national jurisdiction, climatic changes may lead to changes in the migration patterns and areas of distribution of important fish stocks, with consequences for commercial fisheries. Although ice conditions are rapidly changing, there are, as yet, no indications of any such changes for commercial fishing. States must respect the principles and rules contained in the Straddling Stocks Agreement [38], to prevent their vessels from fishing in areas not yet regulated, until a management regime is in place. It is, for instance, prohibited for Norwegian flagged vessels to fish in unregulated parts of the high seas, and thus no Norwegian fishing boats would be licensed to fish in the high seas area of the Arctic Ocean before a management regime is in place.

In spite of the obvious danger of writing as briefly as I am doing, particular reference should be made to the important body of law constituted by international environmental law instruments as part of the existing and comprehensive legal framework applicable to the Arctic Ocean. Activities of coastal States and other users in the Arctic Ocean have to be conducted within the framework of their international environmental law obligations, including notably the *Convention on Biological Diversity* [11]. The OSPAR [32] convention to protect the marine environment of the North-East Atlantic may collect important knowledge and contribute to the development of frameworks to make sure that human activity in the area can operate within sustainable frames. Any possible activity should be preceded by a thorough environmental impact assessment. In this regard, the Espoo [14] convention on environmental impact assessment in a transboundary context could also play an important role. All relevant States should be encouraged to ratify and fully implement this instrument, which also has a bearing on activities that may impact the Arctic Ocean.

Fundamentally, the action of coastal States should be based on the adoption of ecosystem-based approaches to all resource and environmental management. In 2006 the Norwegian Government completed a first comprehensive management plan for the Barents Sea in order to take into consideration the consequences of all human activity and other factors, when making decisions regarding resource and environmental management [25, 27]. Should climate changes make human activity in the Arctic Ocean possible to the extent indicated, Norway would work out a comprehensive management plan in advance of any exploitation of natural resources for waters under its jurisdiction. Such planning would take place in accordance with national legislation and relevant international legal obligations. Ultimately, the effectiveness of international law and good governance will always largely depend on the implementation and concrete action taken at the national levels.

30.7 Particular Role of the Arctic Council

As indicated at the outset [33], the Arctic Council provides the high level forum for cooperation in the Arctic. It is not an international organization and acts on the basis of consensus [9]. Nevertheless, it has a unique policy role in several contexts, in light of its particular mandate focussed both on the promotion of environmental protection and on sustainable development, as well as the significant participation of indigenous peoples organizations in its work.

The Council provides a high level forum to promote cooperation, coordination and interaction on common Arctic issues, including through concrete programmes and projects. It is heavily focussed on science and transparency, operating largely through working groups established for particular purposes and based on input from a variety of scientific projects. Several working groups and projects have already made important contributions to a better understanding of issues relevant to responsible policy-making in Arctic waters. Extensive scientific work related to the Arctic Ocean has been carried out under the umbrella of the Arctic Council, including the *Arctic Marine Shipping Assessment* [4] and *Best Practices in Ecosystem Based Oceans Management in the Arctic* [5] where extensive reporting has been put forward. Declarations adopted at ministerial meetings held every second year have also provided important guidance to the need for action in the appropriate national or international bodies.

The *Tromsø Declaration* [39] on the occasion of the Sixth Ministerial Meeting of the Arctic Council on 29 April 2009 underlined several areas where national action and cooperation are necessary as regards the Arctic Ocean. While expressing concern at the escalating rate of warming in the Arctic, it recalled:

> *that an extensive legal framework applies to the Arctic Ocean including, notably, the law of the sea, and that this framework provides a solid foundation for responsible management of this ocean.*

The *Tromsø Declaration* referred to the need to update the *IMO Guidelines for Ships Operating in Arctic Ice-Covered Waters* [19], also making application of relevant parts mandatory. To this end, important work is currently under way at the IMO. An important shift in the latter work has been to focus on the safety for ships operating in polar waters, and not only in ice-covered waters. This reflects the reality of shifting ice conditions, since receding sea ice may lead to varying degrees of drift ice covering waters. Moreover, on-going work reflects the reality of the particular hazards represented by environmental conditions such as temperature, wind and other conditions (including darkness during winter time) that may influence safety assessments. Focus in this work, which engages the participation of all shipping nations, is not limited to certification requirements for stability and floatability of vessels, but considers also a number of other important factors, including communication and training.

The Arctic Council endorsed in Tromsø a summary of the *Observed Best Practices for Ecosystems-Based Oceans Management*. Moreover, the *Tromsø Declaration* called on Arctic States to negotiate by 2011 an international instrument on cooperation on search and rescue operations in the Arctic. Accordingly, the *Nuuk Declaration* [31] issued on the occasion of the Seventh Ministerial Meeting of the Arctic Council held at Nuuk in Greenland on 12 May 2011 announced the *Agreement on Cooperation in Aeronautical and Maritime Search and Rescue in the Arctic* [6] as the first legally binding agreement negotiated under the auspices of the Arctic Council. The *Nuuk Declaration* also decided to establish a task force to develop an international instrument on Arctic marine pollution, preparedness and response, with results to be presented in 2013.

30.8 Conclusion

In guise of conclusion, further effective national measures and collaborative efforts are needed, both at the national and at the international levels. The management of new risks and opportunities requires good governance, rooted in international law and effective national systems aimed at ensuring compliance. This is necessary to adequately meet both rising challenges and emerging opportunities in the Arctic Ocean. Key to the formulation of effective policies is a keen understanding of the existing comprehensive legal framework applicable to the Arctic Ocean, the scope and depth of on-going cooperation by States in this area and the important interaction of relevant national and international institutions.

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Chapter 31
Cooperation in the Arctic Region: Legal Aspects

Marie Jacobsson*

Abstract Why is it worth discussing the subject of international law and cooperation in the Arctic? Or to put it more bluntly: Do states and organisations have a duty to cooperate in Arctic affairs? And can a state or an organisation claim a right to be involved in Arctic cooperation? Do the Arctic states have any special responsibility? With respect to the first question – why it is worth discussing the subject of international law and cooperation in the Arctic – there are several major reasons why this is so, and they relate to: (a) the need for cooperation in the Arctic; (b) the manner in which cooperation takes place in the Arctic; (c) the development of the international law of cooperation; and (d) the link between the obligation to cooperate and responsibility.

31.1 Need for Cooperation in the Arctic

No one who is operating in the Arctic can survive alone. Cooperation – in one way or another – is a necessity, and even the Norwegian *fångstmän* (maritime hunters) that tried to survive the winter in the Arctic in the end had to depend on cooperation and assistance. Those who live in the Arctic know this. Or, as stated in the invitation to a conference that was held in Helsinki 2010 [5]:

> *The regions of the circumpolar North and the diverse Arctic societies have a reputation for success in managing change. Northerners themselves are leaders in developing political and legal arrangements at regional and local levels that meet the needs of Arctic residents and its fragile environment.*

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*The views expressed in this article do not necessarily represent the view of the Swedish Ministry for Foreign Affairs.

M. Jacobsson (✉)
Ministry for Foreign Affairs of Sweden Department for International Law, Human Rights, and Treaty Law, Stockholm SE-103 39, Sweden
e-mail: marie.jacobsson@foreign.ministry.se

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States too, particularly Arctic states, have recognised the need for cooperation in Arctic matters – a development facilitated by the fall of the Berlin Wall and the subsequent dissolution of the Soviet Union. Before that, most attempts to cooperate, or to establish cooperative arrangements, were viewed with suspicion. Given the security and military realities in the Arctic at the time, this was hardly surprising.

The only real cooperative consultation mechanism specifically addressing an Arctic issue was the so-called *Polar Bear Agreement* [10]. Although the explicit aim of the Agreement was simply to protect the polar bear and the Arctic environment, it proved an important legally binding security and confidence building measure.

The next step on the ladder of cooperation was the establishment of the International Arctic Science Committee (IASC) – cooperation among scientists from the eight Arctic countries. That the establishment of the IASC was a very delicate matter. Two issues were particularly sensitive: who would participate in the cooperation and the reluctance on the part of some *states* to establish a regional institution. States were certainly prompters behind the scientific academies that established the IASC. This is not remarkable: without the consent of states, scientific cooperation cannot take place. Participation in international expeditions, exchange of scientific data and information – all requires a proper legal frame work.

The Murmansk speech by President Mikhail Gorbachev [4] on confidence and security building measures, the need for environmental protection and scientific cooperation in the Arctic, was – given the political realities at the time – received with great scepticism.

It took a wall to fall in central Europe to lower the tensions and increase cooperation in the Arctic.

Today, the situation is quite different. Arctic relations are, to a large degree, built on cooperation.

31.2 Manner in Which Cooperation Takes Place in the Arctic

31.2.1 Cooperation Between Individuals

This is a very simple but sometimes essential form of cooperation that boils down to aiding and assisting each other – a normal, social, individual-based form of cooperation that is so much more important in the Arctic than elsewhere.

31.2.2 Cooperation Between Regions and Societies

The peoples of the North have always been traders. The migration flows are impressive if seen in a historical perspective, and contacts and trade – and hence cooperation – among local societies are crucial. This cooperation has to some extent been institutionalised with establishment of the Northern Forum [8]. This international organisation is composed of sub-national or regional governments from eight northern countries. One important aim of the organisation is to bring regional governors and other executives together so they can address common political, environmental and economic issues. The membership of the Northern Forum is not restricted to regions in the Arctic countries. Regions in China, Japan and the Republic of Korea are also members of the organisation. The organisation also includes commercial institutions among its members (though the Northern Forum itself is a non-profit organisation).

The Northern Forum is a Non-Governmental Organisation (NGO) with observer status in the United Nations and it is accredited to the United Nations Environmental Programme with a formal cooperation arrangement to the United Nations Development Programme. It has observer status in the Arctic Council and cooperation agreements with the University of the Arctic. It cooperates with indigenous organisations such as the Inuit Circumpolar Conference, the Saami Council and the Russian Association of Indigenous Peoples of the North. In short, the Northern Forum bases its work on cooperation and networking with the aim of improving living conditions for all Northerners in relation to their: environment; sustainable economic development; society and culture; and business support services. The organisation's structure of cooperation can be characterised as functional and institutional.

31.2.3 Cooperation Among Governmental or Other Institutions

Cooperation among governmental or other institutions in the Arctic takes place in a number of fora, such as the Arctic Council, Nordic Council of Ministers, Barents-Euro Arctic Council and Council of the Baltic States [1]. These are all regional organisations and institutions and although established by international agreements, they are policy bodies, not legislative bodies. The rationale for setting up these organs and institutions was the need for enhanced cooperation and coordination.

However, intergovernmental cooperation of relevance for the Arctic reaches far beyond Arctic regional institutional cooperation. It extends to other regional organisations such as the European Union and North Atlantic Treaty Organization, both of which have taken a growing interest in development and cooperation in the Arctic.

But it does not stop there.

The Arctic states cannot act entirely on their own, since much of the airspace and ocean consists of international airspace and international waters. It is not unlikely that part of the ocean floor will remain the *"common heritage of mankind"* under the *United Nations Convention on the Law of the Sea* [13] even after its *Commission on the Limits of the Continental Shelf* [2] has evaluated the submissions from the Arctic coastal states.

Climate change affects the Arctic and the effects there are not limited to changes in the Arctic environment, but have repercussions for other regions as well.

The remedy for climate change in the Arctic does not rest with protective measures taken by the Arctic states alone. In addition, the decrease of ice in the Arctic opens the region for other activities such as shipping and resource exploration, and increased activities bring a need of infrastructure for rescue operations, navigational aid and weather forecasts – just to mention a few examples.

Hence, cooperation also takes place – and must take place – with global institutions and organisations such as the United Nations and its specialised organs such at the International Maritime Organisation, (IMO), the International Civil Aviation Organization (ICAO), and the Food and Agriculture Organization (FAO) – to mention a few.

The fact that such cooperation must take place does not in any case prevent the especially concerned states – the Arctic states – engaging in closer cooperation, as they have done by establishing the Arctic Council as a *"high-level forum"* [9]:

> *to provide a means for promoting cooperation, coordination and interaction among the Arctic States, with the involvement of the Arctic indigenous communities and other Arctic inhabitants on common arctic issues, in particular issues of sustainable development and environmental protection in the Arctic.*

As the only states that have inhabitants in the Arctic, as well as sovereignty and jurisdiction over vast parts of the region, these states have a special responsibility for the sustainable development and management of the area, as shown by the work of the Arctic Council. International law encourages such regional cooperation.

So, as we have seen, in the Arctic we have functional cooperation, state-to-state cooperation and institutional cooperation.

Where is the law in all this?

31.3 International Law of Cooperation

Let me start by stating the obvious: the Arctic Region consists of land, water and air, and international law applies to this region as it does to any region in the world. States have sovereignty over their land and sea territory, as well as over their airspace, and coastal states have certain well-defined sovereign rights in their Exclusive Economic Zones and over their continental shelves beyond the territorial sea, as well as a certain functional jurisdiction. There is no legal vacuum peculiar to the Arctic region.

Cooperation is not defined in international law, and although cooperation does not in itself have an automatic positive effect, the concept of cooperation certainly has positive connotations. When states are encouraged to cooperate, they are obviously not supposed to cooperate to undermine the environment or the security situation. Yet such negative interstate cooperation is not unusual. Encouraging such cooperation would be contrary to international law, since this would mean encouraging illegal acts.

There are three important cases in which the international law of cooperation is particularly relevant to the Arctic, namely, in relation to human rights and indigenous peoples' rights, in relation to security matters and in relation to protection of the environment. There is one important area where states do not have a clear-cut legal obligation to cooperate, but in which they have chosen to cooperate – even through binding international, regional or bilateral cooperation – and that is related to scientific cooperation.

Let us first take a look at the international law of cooperation, in particular the duty to cooperate under international law.

Even though cooperation is not defined in international law, we often refer to a duty to cooperate under international law. Such a rule or principle concerning the duty to cooperate in international law has many facets. It grew out of a need to take a step from mere co-existence to cooperation and it has particular relevance in relation to the concept of the right to development. I will leave that particular aspect aside and instead make some remarks on security, environment and human rights, since these are the three areas in which the duty to cooperate is particularly developed.

31.3.1 Security

Originally stemming from the *Charter of the United Nations* [14] and the so-called *Friendly Relations Declaration* [15], security lies at the heart of the notion of a duty to cooperate under international law. How such cooperation should take place is not regulated. In essence, cooperation can take any form as long as it prevents disagreements evolving into unstable security situations. One tool of cooperation is to enter into delimitation agreements or management regimes. A delimitation agreement is by far the most important confidence and security building measure since it allows for legal predictability and stable development in a region.

As we all know, security is now a wider concept than it used to be and embraces not only military security, but also environmental and human security.

31.3.2 Environment and Law of the Sea

The *Rio Declaration on Environment and Development* declared in its 7th Principle [11] that:

> *States shall cooperate in a spirit of global partnership to conserve, protect and restore the health and integrity of the Earth's ecosystem. In view of the different contributions to global environmental degradation, States have common but differentiated responsibilities. The developed countries acknowledge the responsibility that they bear in the international pursuit to sustainable development in view of the pressures their societies place on the global environment and of the technologies and financial resources they command.*

However, 10 years earlier, an obligation to cooperate was already laid down in relation to the marine environment by the UNCLOS [13].

The obligation to cooperate both on a global and on a regional basis for the protection and preservation of the marine environment is crystal clear as laid down in UNCLOS through Article 197:

> *States shall cooperate on a global basis and, as appropriate, on a regional basis, directly or through competent international organizations, in formulating and elaborating international rules, standards and recommended practices and procedures consistent with this Convention, for the protection and preservation of the marine environment, taking into account characteristic regional features.*

This obligation is further confirmed in important court cases, as clearly stated by the *International Tribunal for the Law of the Sea* [7]:

> *that the duty to cooperate is a fundamental principle in the prevention of pollution of the marine environment under Part XII of the Convention and general international law and that rights arise therefrom which the Tribunal may consider appropriate to preserve under article 290 of the Convention.*

The clear statement in this regard has been further underlined by members of the court.[1]

The UNCLOS obligation to cooperate covers much more than the protection of the environment: it covers conservation and management of highly migratory species, marine mammals, cooperation in cases of marine casualties, the promotion of marine scientific research, the repression of piracy and the suppression of illicit traffic in narcotic substances and psychotropic substances – just to mention a few examples.

That is not to say that states are obliged to cooperate in all conceivable situations. The extent of the obligation is clearly spelled out in the various articles of UNCLOS, ranging from *"may cooperate"* to *"shall cooperate."* But it is clear that when it comes to the protection of the environment, states must cooperate. A few UNCLOS articles stand out far and foremost with regard to obligation to cooperate in species conservation and management *of e.g. highly migratory species, marine mammals, and anadromous stocks*.[2] ITLOS has concluded that under article 64 of UNCLOS read together with Articles 116–119, states have a *"duty to cooperate directly or through appropriate international organizations with a view to ensuring conservation and promoting the objective of optimum utilization of highly migratory species"*.[3]

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[1] See e.g. the statement by L. Dolliver Nelson, President of the International Tribunal for the Law of the Sea, on the Commemoration of the 20th Anniversary of the opening for signature of the 1982 *United Nations Convention on the Law of the Sea* at the plenary of the 57th session of the United Nations General Assembly on 9 December 2002.

[2] *Article 66, para. 4*.

[3] Southern Bluefin Tuna Cases (New Zealand v. Japan; Australia v. Japan), Order of 27 August 1999, Para. 48.

31.3.3 Human Rights and Indigenous Peoples' Rights

States have a duty to cooperate with the United Nations to ensure that human rights are protected, and likewise states have a duty to cooperate with the indigenous peoples in respect of certain issues.

It should be noted that the *United Nations Declaration on the Rights of Indigenous Peoples* [16], emphasizes:

> *indigenous peoples, in particular those divided by international borders, have the right to maintain and develop contacts, relations and cooperation, including activities for spiritual, cultural, political, economic and social purposes, with their own members as well as other peoples across borders"* and that states, *"in consultation and cooperation with indigenous peoples, shall take effective measures to facilitate the exercise and ensure the implementation of this right.*

The Formulation in the *Declaration* bears out the obligation of states to cooperate with indigenous peoples. It is worth noting that the *Indigenous Peoples Declaration* was adopted with 144 states in favour (a majority) but that two Arctic countries were among those who voted against it, namely Canada and the United States. A third Arctic country, Russia, abstained. However, several important states (including Australia and New Zealand) have reversed their positions and now endorse the *Declaration.*

It is worth noting that this Declaration was adopted with 144 states in favour (a majority) but that two Arctic countries were among those who voted against it, namely Canada and the United States. A third Arctic country, Russia abstained. However several important states (including Australia and New Zealand) have reversed their positions and now endorse the Declaration.[4]

Despite the initial reluctance of three of the Arctic states to vote in favour of the *Indigenous Peoples Declaration*, the indigenous peoples have long had legal and politically uncontroversial participation and representation within the Arctic Council and other fora. They would not have had such representation if Arctic issues were dealt with in other organs where only state representation is allowed.

Finally, there is an important area where states have a less clear-cut legal obligation to cooperate, but in which they have chosen to cooperate – even through binding international, regional or bilateral cooperation – and that concerns scientific cooperation. The principle of freedom of scientific research prevails in major parts of the Arctic Ocean. Science and scientific cooperation have proved to be an important currency of cooperation in tense political situations. Regulation

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[4] The Government of Canada and the United States have announced that they would take steps to endorse and review their positions regarding the Declaration. http://www.un.org/esa/socdev/unpfii/en/declaration.html. The importance of the Declaration was further emphasised by the Durban Review Conference, when 182 States from all regions of the world reached consensus on an outcome document in which they welcomed the adoption of the UN Declaration on the rights of indigenous peoples and *"urge[d] States to take all necessary measures to implement the rights of indigenous peoples in accordance with international human rights instruments". (Outcome document of the Durban Review Conference*, 24 April 2009, para.73). http://www.un.org/durbanreview2009/pdf/Durban_Review_outcome_document_En.pdf

of scientific research, i.e. sharing of information, sharing the results of research, encouragement of cooperation and coordination, have long been important features of international and regional agreements in the Arctic region.

31.3.4 Links Between Obligation to Cooperate and Liability and Responsibility

There is a clear link between the obligation to cooperate and liability and responsibility, both in the field of the law of the sea and in environmental law. Already the *Stockholm Declaration* [12] on the human environment expressed in Principle 22 that States:

> *shall co-operate to develop further the international law regarding liability and compensation for the victims of pollution and other environmental damage caused by activities within the jurisdiction or control of such States to areas beyond their jurisdiction.*

This is further addressed more broadly in Principle 13 of the *Rio Declaration* [11]:

> *States shall develop national law regarding liability and compensation for the victims of pollution and other environmental damage. States shall also cooperate in an expeditious and more determined manner to develop further international law regarding liability and compensation for adverse effects of environmental damage caused by activities within their jurisdiction or control to areas beyond their jurisdiction.*

UNCLOS [13] also clearly obliges states to cooperate in the implementation of existing international law and the further development of international law relating to responsibility and liability, as stated in Article 235:

> *With the objective of assuring prompt and adequate compensation in respect of all damage caused by pollution of the marine environment, States shall cooperate in the implementation of existing international law and the further development of international law relating to responsibility and liability for the assessment of and compensation for damage and the settlement of related disputes, as well as, where appropriate, development of criteria and procedures for payment of adequate compensation, such as compulsory insurance or compensation funds.*

Such cooperation already takes place within the International Maritime Organization and the European Union, but is to be further developed.

More recently, the United Nations International Law Commission [6] drafted principles on the allocation of loss in the case of transboundary harm arising out of hazardous activities. The purpose of the draft principles is, among others, to ensure prompt and adequate compensation to victims of transboundary damage.

31.4 Conclusion

Although the international law of cooperation is moderately developed in international law, the most developed and important areas of that law are applicable to the Arctic, namely, the areas of environment, security and human rights, in particular indigenous peoples' rights.

The legal dimension of the necessary cooperation in the Arctic should not be underestimated. It is not until legal instruments and soft law instruments are tested in courts that we know the exact extent of the obligation.

That, does not mean that the Arctic needs a new legal regime. On the contrary, international law already provides for a legal regime and that includes the 1982 *United Nations Law of the Sea Convention*.

But the legal framework may be developed and refined. Through policy instruments, facilitation of cooperation between regions and private companies, states can buttress the framework for cooperation that already exists for the Arctic region and when necessary develop it further and fit it into the legal frame. Who will participate in such processes is entirely dependent on what ought to be regulated.

Last but not least: regional cooperation in the Arctic, as established by the Arctic Council, is the most important functional tool of cooperation in and for the development of the region. The Arctic Council bears evidence of the special responsibility of the Arctic states. International law encourages such cooperation and we are looking forward to seeing that cooperation further developed.

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Part VII
Conclusions

Chapter 32
Conclusions: Building Common Interests in the Arctic Ocean

Paul Arthur Berkman and Alexander N. Vylegzhanin

Abstract Interests are awakening globally to take advantage of extensive energy, shipping, fishing and tourism opportunities associated with diminishing sea-ice in the Arctic Ocean. This environmental state-change in the Arctic Ocean also is introducing inherent risks of political, economic and cultural instabilities. With urgency – building on the *"common arctic issues"* of sustainable development and environmental protection established by the Arctic Council – environmental security offers an holistic context to assess opportunities, risks and infrastructure responses within international law. Special attention is given to law of the sea as the *"extensive international legal framework"* to *"promote the peaceful uses"* of the Arctic Ocean.

32.1 Era of International Cooperation in the Arctic

Toward the end of the Cold War, Soviet President Mikhail Gorbachev [67] made several proposals in his seminal Murmansk speech to mitigate instabilities in the Arctic:

- *"peaceful cooperation in developing the resources of the North, the Arctic;"*
- *"scientific exploration of the Arctic is of immense importance for the whole of mankind.… setting up a joint Arctic Research Council;"*
- *"cooperation of the northern countries in environmental protection;" and*
- *"open the North Sea Route to foreign ships, with ourselves providing the services of ice-breakers."*

P.A. Berkman (✉)
Arctic Ocean Geopolitics Programme, Scott Polar Research Institute, Judge Business School, University of Cambridge, Lensfield Road, Cambridge CB2 1ER, UK
e-mail: berkman@bren.ucsb.edu

A.N. Vylegzhanin
Legal Department of the Council for the Study of Productive Resources, Russian Academy of Sciences, 7 Vavilova Street, Moscow 117997, Russian Federation

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Taking as a whole, these proposals provide a baseline to chart progress with international relations and infrastructure development in the Arctic Ocean from the end of the Cold War to the present into the future.

Among the metrics is the 2010 NATO Advanced Research Workshop (ARW) at the University of Cambridge that was convened with Russian co-directorship to address *Environmental Security in the Arctic Ocean* (Box 32.1).

Box 32.1

Environmental security is defined herein as an integrated approach for assessing and responding to the risks as well as the opportunities generated by an environmental state-change.

As the first formal dialogue between NATO and Russia regarding security issues in the Arctic – even in view of similar NATO events just a year earlier [71] – the ARW itself is a significant demonstration of progress in international cooperation for the high north.

Moreover, as reflected by the papers in this book, the open and forward-looking dialogue that ensued at the ARW is further testament of the international, interdisciplinary and inclusive system of cooperation that is emerging for the Arctic. Coordinated by the NATO Science for Peace and Security Programme, the ARW sheds light from many perspectives about how science is and has been a tool of diplomacy for the Arctic, *"pointing the way for the future"* ([96], this book).

Since the Cold War, the Arctic states and peoples have established that they have common interests in sustainable development and environmental protection in the Arctic. Building on these common interests with a sense of purpose – for the *"near-Arctic states, for Europe and the entire international community"* [67] – environmental security is offered as a holistic framework to address with urgency the consequences of changes in the Arctic Ocean as it is transforming into a new natural system. Effectively responding to the urgencies is relevant to all humankind, especially since [56]:

> *The Arctic is where three of the twenty-first century's greatest challenges intersect: the pressing need for hydrocarbon resources, climate change, and the tendency to securitize areas containing these resources as well as the passages to them.*

32.1.1 Sustainable Development in the Arctic

There was strong support for President Gorbachev's [67] proposal about *"scientific exploration,"* which triggered the 1990 establishment of the International Arctic Science Committee (Table 32.1) to produce *"leading-edge multi-disciplinary research to foster a greater scientific understanding of the arctic region and its role in the Earth*

Table 32.1 International Participation in Arctic Organizations

STATES[a]	ARCTIC ORGANIZATION[b, c]															
	AC[d]	AMEC	BEAC[e]	FARO	IASC	NACG	NAFO[f]	NC	NEAF[f]	NF	OSPA	PB	SAR	SCAP	SPIT	NATO
Afghanistan															X	
Albania															X	X
Argentina															X	
Australia															X	
Austria															X	
Belgium[g]						X					X				X	X
Bulgaria[g]							X		X						X	X
Canada	X		X	X	X	X	X			X		X	X	X	X	X
Chile															X	
China				X	X					X					X	
Croatia																X
Cuba							X		X							
Czech Republic[g]															X	X
Denmark[g,h]	X		X	X	X	X	X	X	X		X	X	X	X	X	X
Dominican Republic															X	
Egypt															X	
Estonia[g]						X									X	X
Finland[g]	X		X	X	X	X		X		X	X		X	X	X	
France[g]	X		X	X	X	X	X				X				X	X
Germany[g]	X		X	X	X	X					X				X	X
Greece[g]															X	X
Hungary[g]															X	X
Iceland	X		X	X	X	X	X	X	X	X	X		X	X	X	X
India															X	

(continued)

Table 32.1 (continued)

STATES[a]	ARCTIC ORGANIZATION[b, c]															
	AC[d]	AMEC	BEAC[e]	FARO	IASC	NACG	NAFO[f]	NC	NEAF[f]	NF	OSPA	PB	SAR	SCAP	SPIT	NATO
Ireland[g]						X					X				X	
Italy[g]			X	X	X										X	X
Japan			X	X	X		X			X					X	
Latvia[g]						X										X
Lithuania						X										X
Luxembourg[g]											X					X
Monaco															X	
Netherlands[g]	X		X	X	X	X					X				X	X
New Zealand															X	
Norway	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X
Poland[g]	X		X	X		X									X	X
Portugal[g]						X			X						X	X
Republic of Korea				X	X		X			X						
Romania															X	X
Russian Federation	X	X	X	X	X	X	X		X	X			X	X	X	
Saudi Arabia															X	
Serbia															X	
Slovakia																X
Slovenia																X
South Africa															X	
Spain[g]	X					X			X		X				X	X
Sweden[g]	X		X	X	X	X		X			X	X	X	X	X	
Switzerland											X				X	
Turkey																X
Ukraine							X									
United Kingdom[g]	X	X	X	X	X	X					X				X	X

STATES[a]	ARCTIC ORGANIZATION[b, c]															
	AC[d]	AMEC	BEAC[e]	FARO	IASC	NACG	NAFO[f]	NC	NEAF[f]	NF	OSPA	PB	SAR	SCAP	SPIT	NATO
United States	X	X	X	X	X	X	X			X		X	X	X	X	X
Venezuela															X	
Number of States	14	4	15	17	16	20	13	5	8	8	15	5	8	8	42	28

[a] Among the 52 states in this table, the 8 Arctic states are highlighted

[b] Highlighted organizations include all of the Arctic states

[c] ***AC*** (1996 Arctic Council), ***AMEC*** (1996 Arctic Military Environmental Cooperation Programme), ***BEAC*** (1993 Barents Euro-Arctic Council), ***FARO*** (1998 Forum of Arctic Research Operators), ***IASC*** (1990 International Arctic Science Committee), ***NACG*** (2007 North Atlantic Coast Guard Forum), ***NAFO*** (1978 *Convention on Future Multilateral Cooperation in the Northwest Atlantic Fisheries*), ***NATO*** (1949 *North Atlantic Treaty*), ***NC*** (1952 Nordic Council), ***NEAF*** (1980 *Convention on Future Multilateral Cooperation in North-East Atlantic Fisheries*), ***NF*** (1991 Northern Forum), ***OSPA*** (1992 *Convention for the Protection of the Marine Environment of the North-East Atlantic*), ***PB*** (1973 *Agreement on the Conservation of Polar Bears*), ***SAR*** (2011 *Agreement on Cooperation on Aeronautical and Maritime Search and Rescue in the Arctic*), ***SCAP*** (1994 Standing Committee of the Conference of Arctic Parliamentarians), ***SPIT*** (1920 *Treaty* Concerning the Archipelago of Spitsbergen, and Protocol)

[d] Arctic Council – In addition to the eight Arctic Member States and the six non-Arctic Permanent Observer States listed in the table, there are six Permanent Participants from Arctic indigenous peoples organizations (Arctic Athabaskan Council, Aleut International Association, Gwich'in Council International, Inuit Circumpolar Council, Russian Arctic Indigenous Peoples of the North, and Saami Council). The Arctic Council also involves nine Intergovernmental and Inter-Parliamentary Organizations (International Federation of Red Cross & Red Crescent Societies, International Union for the Conservation of Nature, Nordic Council of Ministers, Nordic Environment Finance Corporation, North Atlantic Marine Mammal Commission, Standing Committee of the Parliamentarians of the Arctic Region, United Nations Economic Commission for Europe, United Nations Development Program, United Nations Environment Program) as well as eleven Non-Governmental Organizations (Advisory Committee on Protection of the Seas, Arctic Circumpolar Gateway, Association of World Reindeer Herders, Circumpolar Conservation Union, International Arctic Science Committee, International Arctic Social Sciences Association, International Union for Circumpolar Health, International Work Group for Indigenous Affairs, Northern Forum, University of the Arctic, World Wide Fund for Nature-Global Arctic Program). Non-Arctic states that include China, Japan and South Korea as well as the European Union have applied to the Arctic Council to become Permanent Observer States

[e] Barents Euro-Arctic Council – Permanent Members (Denmark, Finland, Iceland, Norway, Sweden and Russian Federation with the European Commission) and other states are observers

[f] Includes European Economic Community or European Union

[g] Member of European Union

[h] Includes Greenland (which is not a member of the European Union) and the Faroe Islands as autonomous areas

system" [73]. Today, IASC is an international associate of the International Council of Science with membership from all 8 of the Arctic states plus an additional 11 nations.

With IASC, *"cooperation of the northern countries in environmental protection"* [67] began to take form. Flowing from a Finnish initiative, the *Arctic Environmental Protection Strategy* [5] also was adopted by the eight Arctic states "*for the conservation, sustainable utilization and protection of Arctic ecosystems and natural resources for the benefit and enjoyment of present and future generations."* In effect, IASC and the AEPS were creating synergy with the United Nations World Commission on Environment and Development [151], which had conceptualized a strategy to balance environmental protection, social equity and economic prosperity under the rubric of sustainable development.

To foster sustainable development in the Arctic, in view of distinctions between economic growth and development ([93], this book), the Northern Forum was initiated in 1991 (Table 32.1), declaring at its first General Assembly [104]:

> *the people of the North, through joint knowledge and efforts, are essential partners on the local, national and international level in both the protection of the Northern environment and the sustainable development, as defined in the Brundtland Commission Report, of our regions.*

Also in 1993, the first Conference of Parliamentarians of the Arctic Region (Table 32.1) was convened in Reykjavik. Moreover, that year saw establishment of the Barents Euro-Arctic Council (Table 32.1), recognizing that the *"region was an area of military confrontation during the Cold War"* and that *"close cooperation secures political long-term stability and reduces possible tensions"* [25].

Complementing the success of the Barents Euro-Arctic Council – Norway and the Russian Federation [106] signed a treaty concerning *Maritime Delimitation and Cooperation in the Barents Sea and the Arctic Ocean,* resolving a dispute that had been ongoing for the past 40 years. According to the Treaty, both parties shall abide by a 1,700-km maritime boundary in the Barents Sea and shall not claim or exercise any sovereign rights or coastal state jurisdiction in maritime areas beyond their side ([62], this book). This Treaty promotes sustainable fisheries of important straddling stocks and where petroleum resources do extend across the delimitation line, Annex II on *"Transboundary Hydrocarbon Deposits"* will be applied with intergovernmental and private-law involvement. Such cooperation initiatives are taking root because circumpolar partnerships for sustainable development in the Arctic became a common priority of the surrounding states and peoples after the Cold War ([31], this book).

However, achieving sustainable development *"is easier said than done"* ([35], this book), especially in response to 'megatrends' that are global in scope and *"so powerful that they have the potential to transform society"* [118], such as **climate change or human demand for resources.**

- **Integrated approaches are necessary, particularly to develop effective adaptation or mitigation strategies for the ecosystems and peoples that are affected.**
- **Moreover, it is necessary to build balance, respecting the needs and interests of diverse stakeholders across time.**

Whether the impacts are local or global, developing the Arctic in a sustainable manner will involve *"informed decision-making"* ([35], this book):

> *to understand the pressures and drivers of change, the current state of the system as well as identifying the key indicators that will mark systemic and potential detrimental changes, before the appropriate responses and actions are devised and implemented.*

Moreover, the *"drivers of change"* ([32, 35, 36, 42, 52, 93, 157] – this book) are interwoven, reinforcing that sustainable development in the Arctic Ocean system can only be achieved with holistic cooperation.

32.1.2 Science and Diplomacy in the Arctic

Considerations about sustainable development opened the doors for *"setting up a joint Arctic Research Council"* [67], building on lessons learned from the Scientific Committee on Antarctic Research that has promoted cooperation among allies and adversaries alike since the late 1950s [66, 90]. The outcome is the Arctic Council that was established as a *"high-level forum to"* [113]:

> *provide a means for promoting cooperation, coordination and interaction among the Arctic States, with the involvement of the Arctic indigenous communities and other Arctic inhabitants on common arctic issues*, in particular issues of sustainable development and environmental protection in the Arctic.*

Reflecting limitations of that post-Cold War period, when it was necessary to establish basic levels of cooperation across the Arctic without complication, the asterisk (*) in the Declaration denotes the *"Arctic Council should not deal with matters related to military security."*

Although it is *"without legal personality"* [34], the Arctic Council has achieved considerable success in generating policy-relevant knowledge about the Arctic and bringing Arctic issues to the attention of global society. Moreover, with inclusion of indigenous peoples, the Arctic Council has set itself apart *"from other regional, multi-lateral organizations"* ([23], this book) and involved those *"who contribute least to the problem but have the most to lose"* ([49], this book). Importantly, this inclusion provides an opportunity *to "mobilize and apply the experience, knowledge and wisdom of Indigenous peoples"* ([49], this book), who have demonstrated resilience in the face of climate changes over millennia, as elaborated in the *Anchorage Declaration* [9].

Progress of the Arctic Council has been fostered by its six working groups:

- Arctic Monitoring and Assessment Program (AMAP)
- Protection of the Arctic Marine Environment (PAME)
- Arctic Contaminants Action Program (ACAP);
- Conservation of Arctic Fauna and Flora (CAFF);
- Emergency Prevention, Preparedness and Response (EPPR); and
- Sustainable Development Working Group (SDWG).

All of these working groups, except ACAP and SDWG, emanated from the *Arctic Environmental Protection Strategy* [5].

As discussed throughout this book, there are many products of the Arctic Council's working groups [15], including the: *Arctic Climate Impact Assessment* [2, 3]; *Arctic Human Development Report* [6]; *Arctic Oil and Gas Assessment* [10]; *Arctic Marine Shipping Assessment* [8]; and Arctic Ocean Review [12]. Building on these projects, an Arctic Change Assessment (ACA) is now being designed as a 6-year project under the auspices of the Arctic Council ([52], this book) to:

> *provide new scientific knowledge and insights that can extend and deepen the necessary foundation for effective decision-making, policy development and action in the Arctic region.*

With the 2011 decision to establish a Secretariat [16, 17] and the signing of a binding search and rescue agreement [19] at its ministerial meeting in Nuuk, the Arctic Council clearly is entering a new phase in its evolution *"as the primary forum regarding the governance of the Arctic"* ([23], this book).

Moreover, the *Agreement on Cooperation on Aeronautical and Maritime Search and Rescue in the Arctic* (Appendix III) that was signed by all Arctic states at the ministerial in Nuuk in May 2011 is the *"first legally binding agreement established under the auspices of the Arctic Council"* [19] and the first Arctic-specific agreement signed by all of the Arctic states. This next phase in the evolution of Arctic cooperation clearly involves the Arctic Council, which is uniquely positioned to facilitate high-level networking among international institutions (Table 32.1) with regard to Arctic matters. Perhaps the most significant challenge facing the Arctic Council is a matter of inclusion – engaging with "observers" [17] and appropriately accommodating Arctic interests of non-Arctic states (Table 32.1) that notably includes China [87] as well as the European Union ([35, 42, 132], this book).

Throughout its history, contributions of *"science and research to the collective understanding of the circumpolar Arctic"* [113] have been fundamental to the Arctic Council. **These science contributions involve:**

- ***Science as an instrument for Earth system monitoring and assessmen*t as well as an *essential gauge of changes over time and space*.**
- ***Science as a source of invention and commercial enterprise* as well as an *early warning system*.**
- ***Science as a determinant of public policy agendas* and an *element of international institutions.***
- ***Science as one of the "subsidiary means for the determination of rules of law,"* as provided by the International Court of Justice [77].**
- ***Science as an element of continuity in our world*, from the past into the distant future, based on an evolving foundation of prior knowledge.**
- ***Science as a tool of diplomacy*, fostering open dialogues that are crucial to protect our common welfare and the world we live in.**

Together, these features of *"science diplomacy"* [30] reflect the international, interdisciplinary and inclusive planning that is necessary to balance national interests and common interests for effective stewardship of the Arctic Ocean.

32.2 Dimensions of Arctic Ocean Security

32.2.1 Risks of Instabilities

While the Arctic includes both terrestrial and marine areas [6] – the international urgencies are in the Arctic Ocean where issues, impacts and resources cross as well as extend beyond the boundaries of nations (Fig. 32.1a–f). In this transboundary system – especially given the environmental state-change in the Arctic Ocean [27, 29] – there are geopolitical issues that will influence sustainable development across the maritime region at the top of the Earth [60]:

> *in view of the role of climate change as a 'threats multiplier'…. environmental changes are altering geo-strategic dynamics of the Arctic with potential consequences for international stability.*

Urgencies associated with these *"threats"* are characterized in terms of climate security, energy security, environmental security, food security, human security, military security, national security and other security types.

The common feature of these 'n-security types' is that they represent risks of political, economic and cultural instabilities. In many Arctic communities, *"small size of internal markets, a narrow resource base, and dependency on a few key commercial resources is a main source of instability"* ([93], this book). For example, "*traditional livelihoods are threatened as impacts from climate change disrupt hunting and fishing – especially since polar bears, seals, whales and some fish species depend on sea ice*" ([42], this book). Similarly, there are risks that northward movement of fish stocks, possibly accompanied by stock declines further south, will impact interstate relations in the region, recognizing especially the repeated *"fish wars*" (1958–1961, 1972–1973, 1975–1976) in the adjacent North Atlantic ([21], this book). It also is important to recognize that preservation of biodiversity and maintaining ecosystem services is fundamental to sustainable development in the Arctic Ocean ([35], this book).

There are *"potential conflicts between indigenous and commercial uses of Arctic waterways"* as well as unsettling consequences for Arctic nations with *"the emergence of China, Japan and Korea as Arctic maritime nations"* ([36], this book). There also is *"potential for disagreements between the Arctic coastal states and the remaining three members of the Arctic Council (Iceland, Sweden, and Finland), and, perhaps more problematically, between Arctic and non-Arctic states"* ([21], this book). In effect, the Arctic Ocean is becoming *"like any other ocean"* with "*an increase of activities that may involve both cooperation and conflict"* ([72], this book).

With new opportunities in the Arctic Ocean there also will be new risks, some of which will involve cumulative or collateral impacts associated with multiple uses. For example, the Barents Sea produces some of the richest fisheries in the world. This area also has the heaviest ship traffic [59] along with the largest potential hydrocarbon deposits for exploitation [65] in the Arctic Ocean. An *"accidental spill*

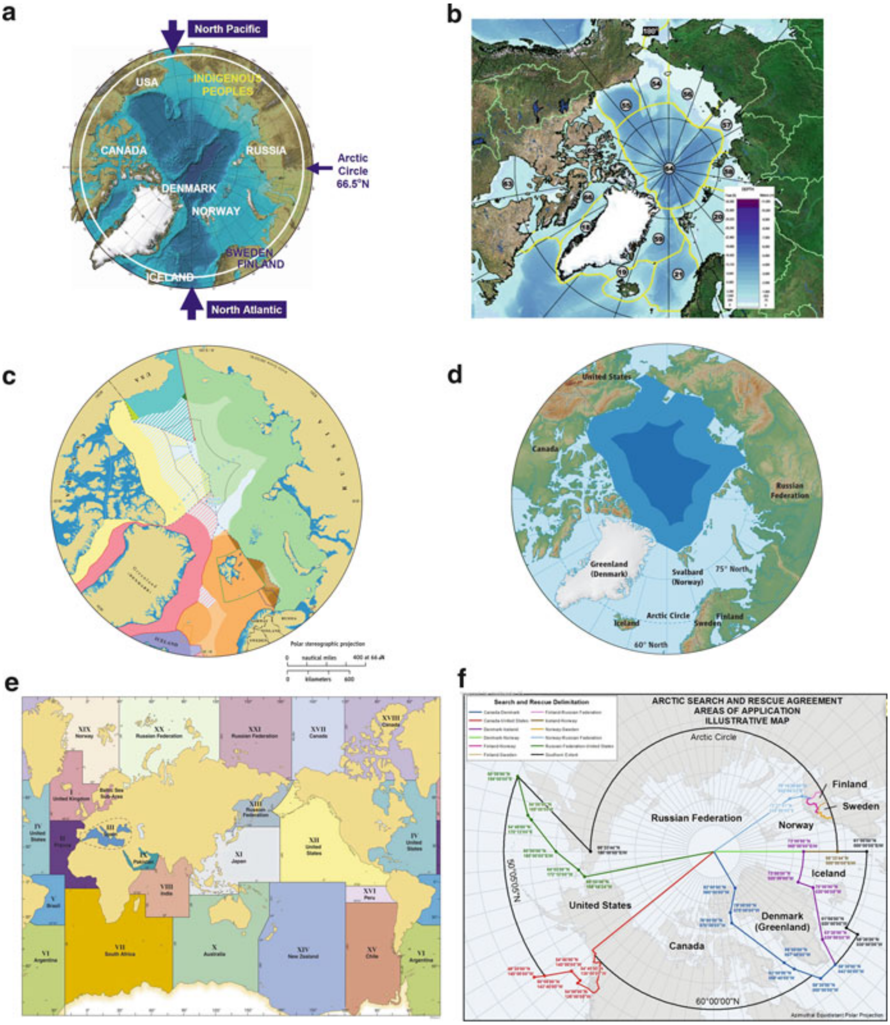

Fig. 32.1 Diverse boundary configurations covering the Arctic Ocean. (**a**) Southern limit based on the astronomical boundary of the Arctic Circle at 66.5° North latitude (*white circle*); (**b**) Large Marine Ecosystem boundaries [8]; (**c**) Potential continental shelf limits of the Arctic coastal states [74]; (**d**) Exclusive economic zones (*light blue*) and high seas (*dark blue*) [29]; (**e**) Meteorological/Navigational Areas [79, 84]; and (**f**) Search and rescue areas of the Arctic states [19]

of oil or other hazardous and noxious substances" in this marine area *"could have large economic, social and environmental impacts"* [8].

More generally, instabilities are herein defined as events or operations requiring resources in an unplanned manner or at the expense of previously prioritized activities. These resources could be financial, diplomatic or intellectual capital as well as tangible assets that are relevant to the security and welfare of the governments and the human populations that they represent. As observed by Achim Steiner [130], Director of the United Nations Environment Programme:

> *All these issues – from energy security and climate security, to water and health security – are ultimately just part of a far wider issue not only for this but for generations to come, namely environmental security.*

The generalized definition of environmental security (Box 32.1) is without reference to the cause of the environmental state-change, which could be related to indirect impacts of the Earth's climate or direct impacts from specific human activities, such as pollution.

For the Arctic Ocean – even though there are historic challenges to convene open dialogues to address security issues – the Russian Federation [122] policy does suggest common ground in the *"sphere of environmental security:"*

> *preservation and maintenance of environment protection of the Arctic, liquidation of ecological consequences of economic activities in the conditions of increasing economic activity and global changes of climate.*

"Environmental security" in the Arctic also is discussed within Unites States policies [117]. Moreover, *"environmental security"* resonates with the indigenous peoples of the Arctic [85], whose involvement is *"critical"* ([109], this book).

Importantly, the concept of environmental security is aligned directly with *"sustainable development and environmental protection,"* which the Arctic states and indigenous peoples have established as *"common arctic issues"* [113]. However, like sustainable development, *"environmental security can only be dealt with by joint management and multilateral procedures and mechanisms"* [151] that extend beyond the Arctic states.

It has long been considered that the *"notion of environmental security is particularly relevant to the Arctic, for several reasons"* [37]:

> *The first concerns the fragility of northern ecosystems and their extreme vulnerability to any human disturbance. Second, the area has a profound influence upon global (or at least hemispheric) environmental processes, such as atmospheric and ocean circulation, global warming, and ozone layer depletion. Finally, environmental factors are closely linked to longstanding, but now changing, strategic military objectives in the Arctic.*

These concerns still are on point for the Arctic Ocean, reflecting the enduring relevance of the observation that *"security problems that have accumulated in the area should be resolved above all"* [67].

32.2.2 Elephants in the Room

A ponderous issue that is actively avoided, for whatever reasons, can be considered as an 'elephant in the room.' Metaphorically speaking, in the Arctic Ocean there are several pachyderms.

As actions justified in terms of security become more prominent throughout the Arctic, the injunction that the Arctic Council *"should not deal with matters related* *to military security"* has become an anachronism in the *Ottawa Declaration* [113] just like the need to *"promote interest in Arctic-related issues"* [113]. Even at that time, there were cooperative efforts involving military assets, mostly notably the Arctic Military Environmental Cooperation programme ([7]; Table 32.1). Reality is that the Cold War ended two decades ago and circumpolar cooperation has progressed among all Arctic states and peoples ever since.

Prime Minister Putin's [115] comments about *"preserving the Arctic as a zone of peace and cooperation"* suggest that trust among the Arctic states has matured. This characterization is further reflected in the saying from Norwegian Foreign Minister Jonas Gahr Støre [135]: *"high north – low tensions."*

"That said, the increase of military presence in the High North is inescapable" ([57], this book). *"Very substantial new military capabilities are now being developed and deployed in the region"* ([72], this book).

In this era of Arctic cooperation, avoiding shared dialogues about military and security considerations has become a practical limitation on sustainable development in the Arctic Ocean, contrary to the *"common arctic issues"* espoused by the *Ottawa Declaration* [113]. With low tensions, there is a low threshold to establish shared dialogues that will both promote cooperation and prevent conflict in the Arctic Ocean, where security issues are much broader than military security.

The environmental state-change will *"require a fundamentally different approach to the planning, technology, and deployment of security assets"* [24]. Practically speaking, there is opportunity to consider the *"changing, strategic military objectives in the Arctic"* [37] that already are a matter of ongoing public dialogue [110, 125–127], especially with *"cooperative and transparent approaches"* ([154], this book).

Moreover, as noted by the NATO Supreme Allied Commander Europe, Admiral James Stavridis [128], *"not all military capabilities are designed for force:"*

> *Ultimately, peaceful activities in the Arctic Ocean are something that will not be achieved by military means alone, but by the collective cooperation of our civilian leaders and their partners across the fabric of our societies.*

Involvement of military assets *"does not reflect any heightened tensions in the area, but rather is simply a prudent responses to new conditions"* ([20], this book).

In perspective, as recently as 2009, *"in keeping with the scope of the Arctic Council, naval or military vessels were not included"* in the Arctic Marine Shipping Assessment ([8, 36], this book). Involvement of defense ministries in the Arctic search and rescue agreement [19] clearly signals a new willingness among the Arctic states to consider the full suite of assets available for their sustainable development ([154], this book). These assets also are vital for *"peacebuilding"* [133], which underlies the stability that is necessary for sustainable development in the Arctic Ocean.

Yet, while the *Ottawa Declaration* [113] promotes cooperation with regard to sustainable development and environmental protection – there is no mention of *"peace."* This omission was intentional since *"peace and security of the Arctic"* clearly were being discussed at the time [13] leading up to the *Ottawa Declaration*

[113]. Moreover, specific objectives of the Arctic Council were being crafted to *"facilitate cooperation generally among its members, and in particular, with respect to the following matters"* [114]:

> *protection of the environment, coordination of scientific research, conservation of living resources, economic development, health and well-being of the Arctic inhabitants, and peaceful uses of the Arctic.*

All of these objectives were incorporated into the *Ottawa Declaration* [113], except for *"peaceful purposes only,"* contrary to the central theme of the Gorbachev [67] speech – *"Let the North Pole be pole of peace"* – that motivated establishment of the Arctic Council.

Active avoidance of the term *"peace"* continued over the next decade in all ministerial declarations of the Arctic Council. Even in the *Ilulissat Declaration* [80] of the five Arctic coastal states, in which they promoted their *"stewardship role"* – peace was not mentioned. This situation began to change only recently with the *Tromsø Declaration* of the Arctic Council [14], which confirmed *"that in international relations the rule of law is a prerequisite for peaceful regional development."* Subsequently, the *Nuuk Declaration* of the Arctic Council [16] recognized *"the importance of maintaining peace, stability and constructive cooperation in the Arctic."*

Individually, Arctic states express their security interests with different emphases on transboundary issues, such as peace (Table 32.2). For example, the *Strategy for the Arctic* from Denmark [55] includes an entire section on: *"Peaceful, Secure and Safe Arctic."* The *State Policy* of the Russian Federation [122] refers to the "*maintenance of the Arctic as a zone of peace and cooperation"* and the *"maintenance of the peace and stability in the Arctic region."* The *Arctic Region Policy* of the United States [145] encourages *"the peaceful resolution of disputes in the Arctic region."* Peace also is mentioned in the Arctic strategies of Norway [63, 106], Iceland [76] and Sweden [136]. In contrast, neither *"peace"* nor *"peaceful"* are referenced in the *Northern Strategy* of Canada [40].

Consequently – despite their paramount importance – peace and stability in the Arctic region have yet to be established explicitly as *"common arctic issues"* among all states and peoples. Part of the problem is cynicism when discussions about peace are cast conversely in terms of conflict or when foreign policies equate peace with demilitarisation.

Even though *"there are no large geopolitical fault lines in the Arctic region and no resource wars on the horizon"* ([154], this book) – with lack of resolve about peace in the Arctic, the situation is ambiguous, opening the door for alarming and alarmist rhetoric to undermine diplomatic efforts. Conveyed by popular writers as opposed to *"those who possess a more intimate knowledge of recent developments,"* the alarmist interpretations are being fueled by *"neo-realist/geopolitical"* rather than *"socio-ecological systems"* paradigms ([157], this book). These paradigms parallel the extent of commercial activities and effectiveness of governance strategies that are considered as primary drivers for the *"plausible futures"* in the Arctic Ocean [8].

Table 32.2 Transboundary issues addressed by the Arctic states in their Arctic security policies[a]

ARCTIC COASTAL STATE	TERMS THAT REFLECT TRANSBOUNDARY ISSUES					
	Environment	*Fisheries*	*Indigenous*	*Navigation / Shipping*	*Peace / Peaceful*	*Science / Scientific*
Canada						
Denmark						
Finland						
Iceland						
Norway						
Russia						
Sweden						
United States						

[a]Based on full-text searching of terms in the following Arctic strategy documents: Canada [40], Denmark [55], Finland [63], Iceland [76], Norway [105], Russian Federation [122], Sweden [136] and United States [145]

This conflict of perspectives will continue to thrive as long as governments avoid open, active and shared dialogues about military, security and peace issues in the Arctic Ocean. Looking forward, a productive avenue could be to wrap these issues within the rubric of environmental security (Box 32.1) and address them in high-level forums other than the Arctic Council.

In this regard – with 24 of the 28 NATO nations already involved in Arctic organizations (Table 32.1) – the NATO-Russia Council could be an 'all-weather forum' to address Arctic Ocean environmental security in a transparent and ongoing manner [70, 99]. As further noted [135]:

> *NATO and Russia are now seeking joint approaches to common challenges. The NATO-Russia-Council (NRC) is an important forum. This steadily growing cooperation – and shared sense of responsibility for security and safety in the transatlantic area – are something we also bring with us with respect to common High North issues.*

Convened predominantly by United Nations organizations, the Environmental and Security Initiative [58] may be another forum for the United States and Russian Federation along with other states to establish an open and ongoing dialogue to address the risks of political, economic and cultural instabilities in the Arctic Ocean.

Absent diplomat-level dialogues about environmental security in the Arctic Ocean, which would help to dispel perceptions of a 'new great game' versus the actual international cooperation, there is complacency as a significant risk in itself. The enduring challenge in the Arctic Ocean is to promote cooperation as well as to prevent conflict – two sides of the coin of peace [27] – which is an integrated approach that is in the common interest of all.

32.3 Arctic Ocean Infrastructure

> *The Arctic is now experiencing some of the most rapid and severe climate change on Earth. Over the next 100 years, climate change is expected to accelerate, contributing to major physical, ecological, social and economic changes, many of which have already begun.*
>
> ACIA [2]

A decade after the Cold War ended, research began to reveal that the Arctic Ocean was transitioning from a permanently sea-ice cap to a seasonally ice-free sea [50, 120, 150]. It is now clear that the sea-ice has been thinning much more rapidly than decreasing in aerial extent [18].

Through the late twentieth century, *the "sea ice extent shrank at a relatively modest rate of 3–4 % per decade,"* while the thickness decreased around 40 % during the same period ([149], this book). Moreover, the sea-ice changes have been accelerating this century. Outcome is the Arctic Ocean already has flipped from a persistent system with multi-year sea ice throughout the year to a variable system covered mostly by first-year sea ice during the winter and open water during the summer [107].

For the Arctic Ocean system, the global question is how to respond to its transformation during the twenty-first century. The answer relies, in part, on an integrated strategy to assess the risks as well as the opportunities that are emerging from the environmental state-change in the Arctic Ocean (Box 32.1). Impact responses further require prioritization in terms of their urgency and feasibility so that they can be implemented in a **systemic manner across the Arctic Ocean over time with regard to:**

- **Point emergencies (e.g., rescue of persons from a sinking ship);**
- **Transitory impacts (e.g., clean-up of an oil or gas spill); and**
- **Global impacts (e.g., adaptation to marine ecosystem changes).**

Such an infrastructure system will involve physical, jurisdictional and policy components to achieve the necessary balance for sustainable development in the Arctic Ocean during the coming years and decades. *"The future history of the Arctic is now"* [101]. There is urgency.

32.3.1 Response Assets

Spatial planning for the high north is like the early twentieth century when nations recognized that they would need to accommodate automobile traffic across continents; projecting vast grids of paved roads and highways that would take the next 50 years to construct within and between nations. As noted at the *National and International Good Roads Convention* in 1903 by President Theodore Roosevelt [119]:

> *When we wish to use descriptive terms fit to characterize great empires… invariably one of the terms used is to signify that that empire built good roads. When we speak of the Romans, we speak of them as rulers, as conquerors, as administrators, as road-builders.*

With this century perspective, environmental security issues in the Arctic Ocean are both urgent and protracted, requiring sustained advances with coordinated infrastructures that fundamentally involve Arctic coastal states, non-coastal states and indigenous peoples along with global civil society (Table 32.1).

Expanding access to the Arctic Ocean is awakening significant economic opportunities [131]. Global trade routes through the Arctic Ocean (see [36], this book) – which would shorten Atlantic-Pacific transits by a third compared to crossing through the Suez and Panama canals [94] – could develop into trillion-dollar opportunities [134], reshaping the global balance of power.

Already, there is open water during the summer and first-year sea ice during the winter from the Bering Strait to the Barents Sea [107], creating potential year-round opportunities for ice-strengthened vessels to transit with icebreaker escorts across the Northern Sea Route (NSR). After monitoring NSR shipping since 1933 ([39], this book) – in August 2011 the "*Vladimir Tikhonov"* became the largest supertanker (162,300 tons deadweight) to transit the NSR and in a record 7.4 days. The following month, the tanker *'Palva'* (74,940 tons deadweight) eclipsed the NSR transit record in 6.5 days with an average speed about 14 knots. Also in September 2011, the *'M/V Sanko Odyssey'* became the first Japanese tanker and largest bulk carrier (74,800 tons deadweight) to cross the NSR. Moreover, in a year of firsts, more than 834,900 tons of cargo (82% of which was hydrocarbons) was transported in 2011, which is an absolute record for the NSR.

Clearly, the proposal *to "open the North Sea Route"* [67] is becoming a reality, and as stated by Russian Prime Minister Vladimir Putin [116], "*developing modern infrastructure along the Northern Sea Route is a major objective:*"

> *We are going to considerably expand our ice-breaker fleet. Today we have 10 icebreakers. We intend to build another three all-purpose nuclear-powered icebreakers and six diesel-electric ones before 2020. We have allotted 38 billion roubles for this purpose until 2014.*

The infrastructure to support such shipping also will include port facilities and regulatory systems along with *"search and rescue or emergency response capability"* [8], as provisioned by the 2011 Arctic search and rescue agreement ([19]; Fig. 32.1f). With increasing Arctic marine traffic, accurate meteorological and oceanographic monitoring and forecasting systems will be needed to complement the Navigational and Meteorological Areas that have been established for the Arctic Ocean (Fig. 32.1e) by the International Maritime Organization (IMO), International Hydrographic Organization and World Meteorological Organization as part of the World-Wide Navigational Warning System [84]. In addition, Arctic sea lanes will be implemented, like the *"mandatory sea routing system and traffic separation scheme for shipping in difficult Arctic climate conditions outside of the northern coast of Mainland Norway from Vardø to Røst, based on agreement between Norway and Russia"* ([62], this book).

There also will be increasing urgency for high-resolution bathymetric charts [88] in all navigable coastal areas. Moreover, objective data about pan-Arctic ship traffic will need to be collected consistently and processed real-time for operational decision-making throughout the year, which already is feasible as demonstrated by the mapping of Automatic Identification System data collected daily from satellites for 12 months in 2010–2011 [59]. Taken together, a circumpolar network is envisioned across the twenty-first century with physical as well as institutional infrastructures (see below) superimposed across the Arctic Ocean, where the challenges *"are not limited to national concerns and cannot be addressed by the governments of any one nation"* ([23], this book).

While diminished sea ice may enhance the opportunities for trade, tourism or fisheries in the Arctic Ocean – among all of the commercial activities, *"energy is the crucial factor in the planet's economic development"* [64]. Since the 1970s, Arctic regions of the Unites States and Russia followed later by Canada and Norway have been producing both oil and gas from the Arctic Ocean. With rising global demand, *"oil and gas activity in the region is expected to increase"* [10]. Most importantly, potential energy supplies in the Arctic Ocean are significant on a global scale [65]:

> *The United States Geological Survey* [USGS] *has assessed the area north of the Arctic Circle and concluded that about 30 % of the world's undiscovered gas and 13 % of the world's undiscovered oil may be found there.*

More than 80 % of the USGS estimated hydrocarbon resources *"are believed to be offshore"* where it will be especially important to establish a *"consistent and effective regulatory framework in support of oil and gas development"* ([32], this book). In addition, *"according to some expert assessments, 20–46 billion tons of oil and 0.5–1.5 trillion cubic meters of gas are deposited in the sea sub-soil areas adjacent to the coasts of the Russian Federation alone"* ([147], this book).

The challenge is to establish operational standards for hydrocarbon resource activities, including transport, that are *"effective"* in the Arctic marine environment. Certainly, perfect standards would prevent any accident spills. Realistically, however, there will be accidents, which is the reason for contingency planning. However, contingency plans resulting from the *"best available technology,"* as reflected by lessons from the BP Deepwater Horizon oil spill ([124]; reprinted in this book), only have merit until the bar is raised by the next serious incident.

In the Arctic marine environment, the limitations of contingency planning are exacerbated by polar conditions ([124]; reprinted in this book). Sea-ice cover makes it difficult to locate oil underneath and to deploy containment solutions, such as booms, skimmers, burning or chemical dispersants. Freezing seawater temperatures slow biodegradation, compared to warmer environments like the Gulf of Mexico. Remote conditions limit the capacity for emergency responses, including deployment of containment assets or drilling of relief wells. As a general observation, operating conditions in the Arctic Ocean neutralize known countermeasures to mitigate accidental hydrocarbon releases there. Considering issues of global significance as well as potential impacts on dependent and associated ecosystems, environments and human populations – energy resource activities have great potential to influence political, cultural and economic instabilities in the Arctic Ocean region.

There are many uncertainties about how to balance the diverse interests and capabilities for responding to the emerging opportunities and impacts in the Arctic Ocean.

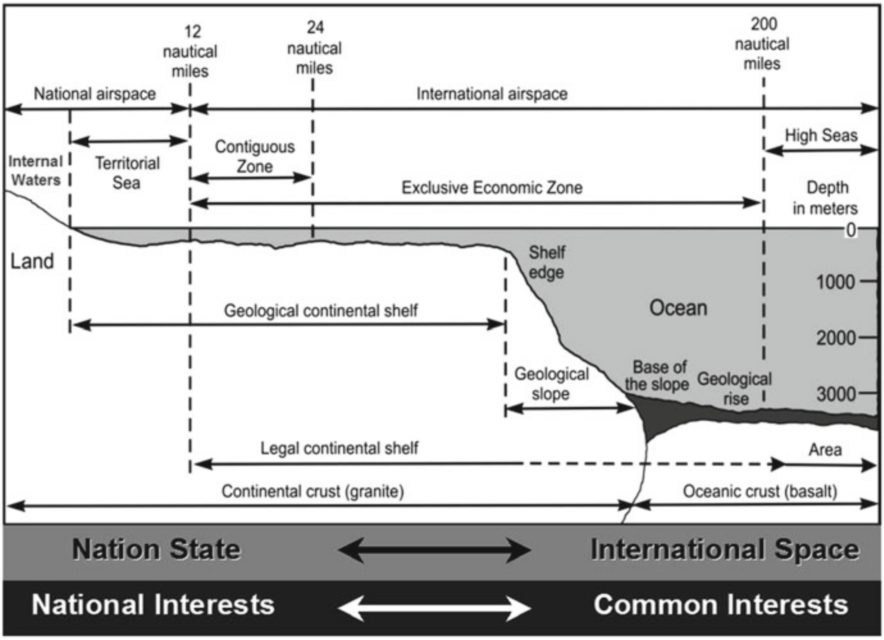

Fig. 32.2 Zones throughout the world ocean, from the baselines of coastal states into the international spaces (i.e., the high seas and deep sea) beyond sovereign jurisdictions, reflecting the gradient from national interests into common interests. The zones (*internal waters, territorial sea, contiguous zone, exclusive economic zone, high seas, continental shelf, area, national airspace and international air space*) are defined by customary international law and the *United Nations Convention on the Law of the Sea* [139] with provisions that *"will contribute to the strengthening of peace, security, co-operation and friendly relations among all nations."* (Adapted from United States [144] with addition of sea zones for the *area* and *internal waters*)

"What is clear, however, is that changes in the region's physical environment are likely to present policy planners and political decision-makers with a wide array of challenges that will require extraordinary measures at the national as well as at the regional and international levels" ([21], this book). Among the challenges is planning an integrated pan-Arctic infrastructure to accommodate global activities in the Arctic Ocean.

32.3.2 Holistic Jurisdictional Framework

Looking at the Arctic Ocean from first principles, the region includes the territories of nations along with areas beyond national jurisdiction (Fig. 32.1a–f). The universal legal system to resolve issues and impacts across any boundaries in the Arctic Ocean as well as throughout the world ocean is the law of the sea (Fig. 32.2). This legal framework, which has been evolving for centuries [38], is primary for the five Arctic coastal states [80]:

> *Notably, the law of the sea provides for important rights and obligations concerning the delineation of the outer limits of the continental shelf, the protection of the marine environment, including ice-covered areas, freedom of navigation, marine scientific research, and other uses of the sea. We remain committed to this legal framework and to the orderly settlement of any possible overlapping claims.*

Across a gradient from national to international jurisdictions (Fig. 32.2), ocean zones are referenced to the *United Nations Convention on the Law of the Sea* [139], which provides for "*strengthening of peace, security, co-operation and friendly relations among all nations" – "with due regard for the sovereignty of all States."*

UNCLOS with its 320 articles and nine annexes was opened for signature on 10 December 1982 and entered into force on 16 November 1994. To date, 162 nations have signed UNCLOS [140] with ratifications pending only for 22 of these signatories. All of the Arctic states have ratified UNCLOS except the United States, which is responding to law of the sea under customary international law ([20], this book), but without recognizing the sea floor beyond the continental shelf as the *"common heritage of mankind"* [148].

From the coastal boundary seaward (Fig. 32.2), beyond the territorial sea and contiguous zone is the exclusive economic zone (UNCLOS Article 56) where the coastal state has:

> *…sovereign rights for the purpose of exploring and exploiting, conserving and managing the natural resources, whether living or non-living, of the waters superjacent to the sea-bed and of the sea-bed and its subsoil, and with regard to other activities for the economic exploitation and exploration of the zone.*

Moreover, as stated in UNCLOS Article 234 with regard to ice-covered areas:

> *coastal States have the right to adopt and enforce non-discriminatory laws and regulations for the prevention, reduction and control of marine pollution from vessels in ice-covered areas within the limits of the exclusive economic zone.*

Seaward of the exclusive economic zone is the international space of the high seas (Fig. 32.1d). Generally, underneath the high seas is the area, which is the international space of the deep sea beyond the continental shelf that UNCLOS established as the *"common heritage of mankind,"* (which is the principal stumbling block for United States' ratification of UNCLOS). In some locations, the high seas also may overlie continental shelf.

"Sovereignty, sovereign rights and jurisdiction" [80] of coastal states in the Arctic Ocean are further reflected by the sea zones that they identify in their national policies, as demonstrated, for example, by Presidential policies of the Russian Federation [122]:

> *internal maritime waters, territorial sea, exclusive economic zone and continental shelf of the Russian Federation adjoining to such territories, areas and islands, within which Russia enjoys sovereign rights and jurisdiction under international law.*

and United States [145]:

> *sovereignty, sovereign rights, and jurisdiction in the Arctic region, including sovereignty within the territorial sea, sovereign rights and jurisdiction within the United States exclusive economic zone and on the continental shelf, and appropriate control in the United States contiguous zone.*

Both the United States and the Russian Federation assert their national interests through the exclusive economic zone and across the continental shelf. Even though the outer continental shelf may eventually include sea floor that currently is perceived by some states as the deep sea, neither of these coastal states nor any other states have incorporated the international spaces of the area or high seas as part of their national policies for the Arctic (Table 32.2).

Jurisdictional configurations of the Arctic continental shelf – potentially to the North Pole (Fig. 32.1c) – are influenced by delimitation processes of the Arctic coastal states, which involve the Commission on the Limits of the Continental Shelf (CLCS) according to UNCLOS Article 76 for all except the United States. Indeed, following recommendations of the CLCS [46], Norway already has been shown to have continental shelf that extends beyond 200 nautical miles from the mainland and Svalbard in the Arctic Ocean. Additional CLCS submissions for extended continental shelves in the Arctic Ocean involve the Russian Federation [121], Denmark [54] and Iceland [75]. It is anticipated that Canada [41] will make her submission to the CLCS by 2013. For the United States, historical agreements, including the *Treaty with Russia* [138] and *Convention on the Continental Shelf* [44], are relevant to delimit continental shelf areas in the Arctic Ocean.

Considering any unresolved continental shelf boundaries, in view of the probable distribution of hydrocarbons in the Arctic Ocean [65], most of the deposits are within recognized sovereign jurisdictions that already exist. This means that *"media coverage arguing for hydrocarbon driven conflict and a race 'for the North Pole' is – to put it mildly – exaggerated"* ([92], this book).

Even so, clarification of maritime boundaries and national jurisdictions would help to provide *"building-blocks of international peace and security, and for responsible and sustainable uses"* of the Arctic Ocean ([89], this book). Beyond the 200-mile exclusive economic zones of the Arctic coastal states, *"such cooperation is called for irrespective of the manner in which these Arctic states will delimit the Arctic continental shelf between them"* ([45], this book).

Nonetheless, UNCLOS [139] *"shall prevail, as between States Parties, over the Geneva Conventions on the Law of the Sea of 29 April 1958"* (Article 311 of UNCLOS). Consequently, the Arctic states are differentially obligated with regard to each other and their activities since they are not all States Parties to UNCLOS, undermining their capacity to act in a unified manner in the Arctic Ocean. United States' ratification of UNCLOS *"would greatly enhance the reputation of the Arctic as a stable and predictable region"* ([57], this book).

As the umbrella institution, UNCLOS provides a visionary template to integrate and interpret legal strategies at all scales from all institutions throughout the world ocean. Considering this *"institutional interplay"* [108, 156] with regard to environmental security, just within UNCLOS, there are 17 *"security"* articles and 66 *"environment"* articles that can be integrated [27]. While UNCLOS frames the conduct, responsibilities and rights of states with regard to all zones in the sea (Fig. 32.2) – the challenge is applying this keystone agreement to balance interests in the Arctic Ocean.

32.3.3 Integrated Policy Planning

Integrative perspectives are stimulated by systems analyses. For example, ecosystem approaches are being applied to evaluate interactions among dependent and associated species and habitats in the Arctic Ocean [2, 8]. Additionally, there are integrative tools, most notably geographic information systems that are being applied for marine spatial planning [141]. Within the Arctic Ocean, marine spatial plans (MSP) have been developed for the Beaufort Sea [26] and Barents Sea [33]. Additionally, marine spatial planning for the entire Arctic Ocean is underway with initiatives such as the *Arctic Climate Change, Economy and Society* (ACCESS) project supported by the European Commission [1].

Risk analyses and impact assessments ([52], this book) further elucidate known or anticipated consequences of system changes across an *"array of environmental security issues confronting the Arctic Ocean"* ([36], this book). With common understanding of the risks, the threshold is lowered for common acceptance of the mitigation and adaptation strategies, ultimately facilitating common agreement about policy pathways for sustainable infrastructures. In this integrating process, gap analyses already are being applied to reveal strengths, deficiencies and overlaps among legal solutions ([91], this book).

The solutions involve 'hard laws,' which are binding within or between nations, as well as 'soft laws' involving institutional guidelines and discretionary processes. **Broadly, legal solutions in the Arctic Ocean apply:**

- **Within Arctic states;**
- **Among Arctic states;**
- **Among Arctic and non-Arctic states; and**
- **Among states and non-states parties.**

Within the Arctic states, legal solutions for the Arctic region are integrated effectively into their national security policies (Table 32.2). The underlying laws may be explicit specifically, as with the *Arctic Water Pollution Prevention Act* [22] referenced within the Northern Strategy of Canada [40]. Similarly, the underlying laws may be explicit generally, as in the State Policy for the Russian Federation [122], which reflects a wider body of national legislation for the NSR ([39], this book). In addition, existing and anticipated laws or policies may be implicit, as in the Arctic Region Policy and recommendations of the Interagency Ocean Policy Task Force of the United States [145, 146].

International solutions involve hard-law approaches that are binding among two or more Arctic states. For example, the *Treaty Concerning Maritime Delimitation and Cooperation in the Barents Sea and the Arctic Ocean* [106] entered into force on 7 July 2011 as a shining example of peaceful dispute resolution in the Arctic Ocean ([62], this book). Another international legal solution for the Arctic is the *Agreement on Conservation of Polar Bears* [4], which was signed by the five Arctic coastal states: Canada, Denmark, Norway, Soviet Union (Russian Federation) and United States.

The first hard-law solution signed by all Arctic states with application across the entire region is the Agreement *"to strengthen aeronautical and maritime search and rescue cooperation and coordination in the Arctic"* [19, Appendix 3]. The Agreement establishes search and rescue regions (Fig. 32.1f) that *"shall not prejudice the delimitation of any boundary between States or their sovereignty, sovereign rights or jurisdiction."* Moreover, the Agreement involves applicable regional and global rules, creating an integrated legal model for the Arctic Ocean.

Among Arctic and non-Arctic states, there are globally-relevant institutions that apply to the Arctic Ocean, such as the *United Nations Framework Convention on Climate Change* [142] or the *Convention on Biological Diversity* [43]. Moreover, in addition to international institutions that apply throughout the world ocean, such as the agreement on straddling and highly migratory fish stocks [143], there are regional regimes for the North Atlantic that also may be considered as applicable to some areas of the Arctic Ocean (Table 32.1; [89], this book):

- *Convention on Future Multilateral Cooperation in the Northwest Atlantic Fisheries* [98];
- *Convention on Future Multilateral Cooperation in North-East Atlantic Fisheries* [100];
- *Convention for the Protection of the Marine Environment of the North-East Atlantic* [112];

These institutions – as well as the North Atlantic Coast Guard Forum [97], which includes the eight Arctic states (Table 32.1) – all are named for the North Atlantic, but with mandates extending north of the Arctic Circle (66.5° N latitude). In contrast, the Arctic remit of North Atlantic Treaty Organization (NATO) is unclear.

In addition to specific institutions, the International Maritime Organization [81] involves 169 member states, complementing UNCLOS and providing an integrative framework as the *"United Nations specialized agency with responsibility for the safety and security of shipping and the prevention of marine pollution by ships"*. Among the IMO conventions that have particular relevance to shipping in the Arctic Ocean are ([53], this book):

- *International Convention on the Safety of Life at Sea* [123];
- 1973 *International Convention for the Prevention of Pollution from Ships* as modified by the 1978 Protocol [95];

- *International Convention on Standards of Training, Certification and Watchkeeping for Seafarers* [129];
- *International Convention on Maritime Search and Rescue* [78]; and
- Torremolinos Protocol of 1993 to the 1977 *Torremolinos International Convention for the Safety of Fishing Vessels* [137].

The recent Arctic search and rescue agreement [19] also has become part of the regulatory system for shipping in the Arctic.

To further integrate and enhance the existing conventions with specific emphasis on navigation in Arctic waters, taking into account the specific environmental conditions to meet appropriate standards of maritime safety and pollution prevention, IMO [82] developed *Guidelines for Ships Operating in Ice-covered Arctic Waters.* However, these soft-law *Guidelines* are not legally binding and, following recommendations from the Arctic Marine Shipping Assessment ([8, 36], this book), the Arctic Council [14] urged IMO to make them "*mandatory.*" Subsequently, IMO [83] created *Guidelines for Ships Operating in Polar Waters* with an *"ambitious"* 2012 target to complete a binding polar code that *"would cover the full range of design, construction, equipment, operational, training, search and rescue and environmental protection issues relevant to ships operating in polar waters"* ([53], this book).

Among other soft-law solutions for the Arctic Ocean is the *Offshore Oil and Gas Guidelines* [11] that is contributing to the Arctic Council's development of a binding instrument on cooperation in preparedness and response to marine oil spills. Established by the *Ottawa Declaration* [113], the Arctic Council identifies priority status for the Arctic states and indigenous peoples organizations, effectively as central states parties and non-states parties in the evolving institutional framework for the Arctic. Juxtaposition of roles and responsibilities among the different types of parties in the Arctic Council reflects a step in the evolution of international law with indigenous peoples organizations receiving a level of parity. This trajectory in the international legal capacity of indigenous peoples is further reflected in the Arctic by the progress of Sami parliaments as well as the self-rule government in Greenland, which has a resident population that is nearly 90% Inuit.

Currently, however, with addition of observers in the Arctic Council, there is potential to dilute the influence of the indigenous peoples organizations, who have *"indicated that their viability is much enhanced by, having control over their own fate, sustaining contact with nature, and retaining their cultural identity"* ([93], this book). More broadly, the fact that Arctic challenges and opportunities necessarily involve significant contributions from outside *"raises the question of how the Arctic Council should deal with certain non-Arctic states wishing to participate"* ([132], this book).

Considering the mosaic of hard and soft law solutions relevant to the Arctic Ocean, there are *"gaps in environmental governance, indigenous peoples representation, fisheries management, offshore hydrocarbon activities and shipping"* ([42], this book). The challenge is to address the institutional gaps in an integrated and inclusive manner for the lasting benefit of all in the Arctic Ocean.

32.4 Stewardship of the Arctic Ocean

> *The warming of the Arctic has profound implications for global commerce, with the opening of new shipping routes. It raises the possibility of new energy exploration, which will, of course, have additional impacts on our environment. And Arctic warming has already serious consequences for the indigenous communities that have made their homes there for many generations. The changes underway in the Arctic will have long-term impacts on our economic future, our energy future, and indeed, again, the future of our planet. So it is crucial that we work together.*
>
> United States Secretary of State Hillary Clinton [47]

32.4.1 Inclusion

"The Arctic Ocean is a unique ecosystem, which the five coastal states have a stewardship role in protecting" by virtue of their *"sovereignty, sovereign rights and jurisdiction"* [80]. Responsibilities of the Arctic coastal states are beyond question: the Arctic Ocean is in their backyards, as illustrated from Canada ([153], this book):

> *Our vision of the Arctic as a region of stability, where Arctic states work to foster sustainable development and exercise stewardship for those at the heart of our Arctic foreign policy – Northerners.*

However, there is a question of inclusion versus exclusion if stewardship is exercised just for *"Northerners."* Emphasizing the role of the 'Arctic 5' versus the 'Arctic 8' has fostered the *"impression that a new hierarchy of membership is developing within the Arctic Council"* ([152], this book).

There also is a question of capacity for the Arctic coastal states to resolve the transboundary issues without engaging the broader international community (Table 32.2), especially in a dynamic natural system involving activities that are relevant on a global scale. Moreover, *"the Arctic states cannot act entirely on their own, since much of the airspace and ocean consists of international airspace and international waters"* ([86], this book). Clearly, *"significant international discussions on Arctic issues should include those who have legitimate interests in the region"* [48].

While outside comments about the Arctic Ocean may be construed as interfering with internal matters of the Arctic states, there are *"legitimate interests"* from non-Arctic states ([42], this book), especially as noted by the European Union [61] with regard to:

> *Maintaining the Arctic as an area of peace and stability and highlighting the need for responsible, sustainable and cautious action in view of new possibilities for transport, natural resource extraction and other entrepreneurial activities linked to melting sea ice and other climate* change effects.

Moreover, *"ensuring stability in the Arctic must be a process based on the international law and existing cooperation mechanisms, focusing on civilian economic and scientific collaboration and environmental stewardship as well as protection of the rights and traditions of indigenous people"* ([57], this book).

Similarly, ***"the international law of cooperation is particularly relevant to the Arctic"*** **in relation to (**[86], **this book):**

- ***Human rights and indigenous peoples' rights;***
- ***Security matters; and***
- ***Protection of the environment.***

With a cooperative process that is international, interdisciplinary and inclusive – the *"Arctic region has the potential to serve as an exemplary framework for shared dialogues… when nations manage to envision their long term interests and the balance between their own interests and global ones"* ([69], this book).

32.4.2 Balance

At the heart of stewardship are common interests, providing guiding principles for all involved to avoid *"tragedy of the commons"* [68] where actors pursue their own interests to the detriment of the community. On a global scale, common interests represent an evolving body of international law across a broad suite of institutions that have come into force since World War II [28].

With direct relevance to the Arctic Ocean, initial *"common arctic issues"* have been established as *"sustainable development and environmental protection*" [113]. More specifically, **sustainable development involves balance between:**

- **Environmental protection, economic prosperity and social equity;**
- **Urgencies of the moment and needs of future generations; and**
- **National interests and common interests.**

Balance also equates with stability.

As a component of sustainable development [151], environmental security provides a framework to address risks of economic, cultural and political instabilities arising from the environmental state-change in the Arctic Ocean with urgency. Moreover, as noted by the United Nations World Commission on Environment and Development [151]:

> *The first step in creating a more satisfactory basis for managing the interrelationships between security and sustainable development is to broaden our vision. Conflicts may arise not only because of political and military threats to national sovereignty; they may derive also from environmental degradation and the pre-emption of development options.*

Without balancing urgent and long-term plans, extending across the twenty-first century and beyond, it is likely that a patchwork of institutions and infrastructures will emerge with the limited horizon of political expediency.

To avoid such fragmentation, the challenge is for the Arctic states *"to think and to act in political and legal harmony"* ([147], this book):

> *Of special significance is a proper balance between interests associated with sustainable activities (e.g., fisheries, recreation and subsistence harvesting by indigenous peoples) and more influential 'big-business' industries (e.g., oil and gas sector).*

Such harmony to achieve *"a proper balance"* will be made possible by the Arctic states cooperating through integrative perspectives, processes and institutions.

Among the integrative institutions for the Arctic Ocean is the law of the sea to which the Arctic coastal states *"remain committed"* [80]. More than an umbrella legal framework to cover governance gaps, the law of the sea establishes zones within and beyond sovereign jurisdictions (Fig. 32.2), offering a paradigm to balance national interests and common interests in the Arctic Ocean [27]. Importantly, law of the sea also offers an integrative process to promote cooperation and prevent conflict in the Arctic Ocean by drawing *"a clear distinction between the overlying water column and the sea floor"* ([29]; Fig. 32.1c–d):

> *Ecologically and legally distinct from the sea floor, the overlying water column and the sea surface of the central Arctic can remain an undisputed international area.*

Recognizing this zone in the central Arctic Ocean as a place of peace and international cooperation based on shared environmental security interests would be another important measure ([154], this book).

Contributing to future generations is more tangible today than anytime in human history. With current technologies, we have unprecedented capacity to look back through time across societies with empirical evidence about their interactions in past environments, revealing insights about the consequence of modern and future human activities. We also have expanding capacity to predict future environmental conditions and impacts in our world; reflecting our increasing dependence on accurate observations and objective analyses that are shared in a timely manner to make good decisions.

In this *"age of the Arctic"* [111, 155] – when the *"Arctic must also be seen in a global context, including from the viewpoint of international peace and security"* [51] – there is need to continuously build common interests for the high north, *"ultimately by those responsible at the highest political level"* [102]. As noted by the United Nations Environment and Security Initiative [58]:

> *Peacefully resolving the overriding political, economic and social concerns of our time requires a multifaceted approach, including mechanisms to address the links between the natural environment and human security.*

Environmental security with its international, interdisciplinary and inclusive bridges to the *"common arctic issues"* of *"sustainable development and environmental protection"* [113] is such an approach with hope and inspiration for future generations.

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Appendices

NATO OTAN This workshop is supported by: The NATO Science for Peace and Security Programme

ENVIRONMENTAL SECURITY IN THE ARCTIC OCEAN

NATO Advanced Research Workshop

Scott Polar Research Institute, University of Cambridge, 13-15 October 2010

The Arctic Ocean is being transformed from a permanent ice cap to a seasonally ice-free sea within the next few decades. This is the largest environmental state-change on Earth and it brings potential economic, political and cultural instabilities as well as opportunities that have regional and global implications. Objectives of the NATO Advanced Research Workshop on *"Environmental Security in the Arctic Ocean"* are:

1. Openly and objectively address the potential instabilities and opportunities in the Arctic Ocean as matters of environmental security;
2. Utilize academic institutions as transparent venues to facilitate shared, interdisciplinary and ongoing dialogues that build trust among all Arctic states, indigenous peoples and other stakeholders regarding Arctic Ocean issues; and
3. Consider strategies that both promote cooperation and prevent conflict in the Arctic Ocean.

This NATO Advanced Research Workshop is generously co-sponsored by the: Aspen Institute Dialogue and Commission on Arctic Climate Change; Canadian Polar Commission; Ecologic Institute; John Sloan Dickey Center for International Understanding, Dartmouth College; Judge Business School, University of Cambridge; MGIMO University; NATO Parliamentary Assembly; Scott Polar Research Institute, University of Cambridge; Shell International Exploration and Production B.V; and World Wildlife Fund International Arctic Programme

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Appendix 1: Workshop Agenda

AGENDA

TUESDAY, 12 OCTOBER 2010

18:30 INFORMAL DINNER (Browns Restaurant, 23 Trumpington Street, Cambridge CB2 1QA, www.browns-restaurants.co.uk, Tel: +44-(0)-1223-461-655) – Co-Hosted with the Foundation for Good Governance of International Spaces

WEDNESDAY, 13 OCTOBER 2010

SCOTT POLAR RESEARCH INSTITUTE (Lensfield Road, Cambridge, CB2 1ER, www.spri.cam.ac.uk, Tel: +44-(0)-1223-336-540)

08:15 REGISTRATION

08:45 OPENING SESSION

Welcome by Workshop Co-Directors: **Prof. Paul Berkman** and **Prof. Alexander Vylegzhanin**

Opening remarks: **Dr. Deniz Yüksel-Beten**, Section Head of the NATO Science for Peace and Security Programme

Opening remarks: **Dr. Arturo Chilingarov**, Special Representative of the President of the Russian Federation for International Cooperation in the Arctic and Antarctic, Russian Federation

Opening remarks: **Hon. Jan Ellingsen**, Member of the Norwegian Parliament and Acting Chair of the NATO Parliamentary Assembly - Science and Technology Committee, Norway

Opening remarks: **Hon. Inuuteq Holm Olsen**, Deputy Minister, Department of Foreign Affairs, Greenland

Opening remarks: **Professor David Hik**, President of the International Arctic Science Committee and Professor and Research Chair of Northern Ecology at the University of Alberta, Canada

09:40 SESSION 1 (20-min presentations including questions)

WORKSHOP OBJECTIVES: Chaired by Mr. Graham Jordan, Senior Science Advisor, Royal United Services Institute for Defence and Security Studies and Former Science and Technology Director for the Ministry of Defence, United Kingdom

"Promoting Cooperation and Preventing Conflicts in the Arctic Ocean on the Basis of International Law" – **Prof. Alexander Vylegzhanin**, Director of the Legal Department of the Council for the Study of Productive Resources at the Russian Academy of Sciences and Head of the Department of International Law at the Moscow State Institute of International Relations (MGIMO) University, Russian Federation

"Concepts of Environmental Security in the Arctic Ocean" – **Prof. Paul Berkman**, Head of the Arctic Ocean Geopolitics Programme through the Scott Polar Research Institute and Judge Business School at the University of Cambridge, United Kingdom

10:20 COFFEE

10:40 SESSION 2 (20 min presentations including questions)

ENVIRONMENTAL STATE-CHANGE IN THE ARCTIC OCEAN: Chaired by Mr. R. Andreas Kraemer, Director of Ecologic Institute, Germany

"Diminishing Sea-Ice Cap over the Arctic Ocean" – **Prof. Peter Wadhams**, Professor in the Department of Applied Mathematics and Theoretical Physics, University of Cambridge, United Kingdom

"Anticipating Environmental Responses with Increasing Commercial Activities in the Arctic Ocean" – **Mr. Roderick Johnson**, Chief Coastguard, Maritime and Coastguard Agency, United Kingdom.

"Sustainable Development Considerations in the Arctic Ocean" **– Mr. Nikolaj Bock**, Senior Advisor on International Affairs of the European Environmental Agency, Denmark

11:40 **GENERAL DISCUSSION: Chaired by Mr. R. Andreas Kraemer**, Director of Ecologic Institute, Germany

12:30 **GROUP PHOTOGRAPH**

12:35 **LUNCH**

13:30 **SESSION 3 (20 min presentations including questions)**

GEOPOLITICS OF THE ARCTIC OCEAN: Chaired by Hon. Hannu Halinen, Ambassador for Arctic Affairs and Senior Arctic Official of the Arctic Council, Ministry of Foreign Affairs, Finland

"Arctic Security: The Indirect Approach" – **Prof. Franklyn Griffiths**, Professor Emeritus, Department of Political Science, University of Toronto, Canada

"Interests in the Arctic Ocean from Non-Arctic States" – **Hon. Diana Wallis**, Vice President and Member of the European Parliament from the United Kingdom

"Questions of Stewardship in the Arctic Ocean" **– Amb. Kenneth Yalowitz**, Director of the John Sloan Dickey Center for International Understanding at Dartmouth College and Former United States Ambassador to Belarus (1994–1997) and to Georgia (1998–2001), United States

"Arctic Change Impact Assessment." **Dr. Robert Corell**, Chair of the Climate Action Initiative; Chair of the Arctic Climate Impact Assessment (ACIA) for the International Arctic Science Committee and Arctic Council; and 2007 Nobel Peace Prize Laureate with the Intergovernmental Panel on Climate Change, United States

14:45 **GENERAL DISCUSSION: Chaired by Chaired by Hon. Hannu Halinen**, Ambassador for Arctic Affairs and Senior Arctic Official of the Arctic Council, Ministry of Foreign Affairs, Finland

15:15 **COFFEE**

15:30 **MODERATED PANEL DISCUSSION #1**

SUSTAINABILITY AND SECURITY IN THE CHANGING ARCTIC OCEAN: Moderated by Amb. Hannu Halinen – (Panelists: Hon. Diana Wallis, Mr. Nikolaj Bock, Mr. David Monsma, Prof. Rob Huebert)

17:00 **TOUR OF THE SCOTT POLAR RESEARCH INSTITUTE MUSEUM**

17:30 **ICEBREAKER RECEPTION AT THE SCOTT POLAR RESEARCH INSTITUTE**

THURSDAY, 14 OCTOBER 2010

SCOTT POLAR RESEARCH INSTITUTE

08:45 **SESSION 4 (20 min presentations including questions)**

SHARED SECURITY CONSIDERATIONS IN THE ARCTIC OCEAN: Chaired by Dr. Paal Hilde, Senior Fellow and Head of the Security Policy Section for the Norwegian Institute for Defence Studies

"The Security Implications of Climate Change in the Arctic Ocean" – **Dr. Kristian Åtland**, Senior Analyst, Norwegian Defense Research Institute, Norway

"Arctic Science in the Common Interest" – **Mr. Steven Bigras**, Executive Director, Canadian Polar Commission, Canada

"Cooperation Across Boundaries in the Arctic Ocean" – **Hon. Rolf Einar Fife**, Director General, Legal Department, Ministry of Foreign Affairs, Norway

09:45 **GENERAL DISCUSSION: Chaired by Dr. Paal Hilde**, Senior Fellow and Head of the Security Policy Section for the Norwegian Institute for Defence Studies, Norway

10:30 **COFFEE BREAK**

10:50 **SESSION 5 (20 min presentations including questions)**

RISKS OF POLITICAL INSTABILITIES FROM THE ARCTIC OCEAN, Chaired by Dr. Tatiana Saksina, Arctic Governance Officer, WWF International Arctic Programme, Norway

"United States Policy in the Arctic Ocean as a Case Study" **– Mr. Raymond Arnaudo**, Member, Policy Planning Staff, United States Department of State, United States

"Gaps in International Legal Frameworks for the Arctic Ocean" – **Prof. Timo Koivurova**, Director of the Northern Institute for Environmental and Minority Law and Research Professor in the Arctic Centre at the University of Lapland, Finland

"Interplay between Regional and Global Institutions in Arctic Ocean Governance" – **Dr. Olav Schram Stokke**, Senior Research Fellow at the Fridtjof Nansen Institute, Norway

11:50 **GENERAL DISCUSSION: Chaired by Dr. Tatiana Saksina**, Arctic Governance Officer, WWF International Arctic Programme, Norway

12:30 **LUNCH**

13:45 **SESSION 6 (20 min presentations including questions)**

RISKS OF ECONOMIC INSTABILITIES IN THE ARCTIC OCEAN: Chaired by Prof. David Cope, Director of the Parliamentary Office of Science and Technology for the Houses of Parliament, United Kingdom

"Risks and Challenges of Maritime Activities Identified in the Arctic Marine Shipping Assessment" – **Prof. Lawson Brigham**, Distinguished Professor of Geography and Arctic Policy at the University of Alaska Fairbanks and Former Captain of the United States Coast Guard, United States

"Oil and Gas Development Risks and Opportunities in the Arctic Ocean" – **Mr. Robert Blaauw**, Senior Advisor Global Arctic Theme at Shell International Exploration and Production B.V., The Netherlands

"Environmentally Safe Passage Through Sevmorput: Contemporary Administrative and Legislative Basis" – **Captain Vladimir Mikhaylichenko**, Executive Director of the Noncommercial Partnership of the Coordination of Northern Sea Route Usages and Former Head of the SEVMORPUT (Northern Sea Route) Administration, Ministry of Transport, Russian Federation

14:45 **COFFEE**

15:05 **MODERATED PANEL DISCUSSION #2**

BALANCING NATIONAL INTERESTS AND COMMON INTERESTS IN THE ARCTIC OCEAN: Moderated by Prof. Oran Young, Professor of International Institutions at the Bren School of Environmental Science and Management, University of California Santa Barbara and Chair of the Scientific Committee for the International Human Dimensions Programme – (**Panelists: Ms. Patricia Cochran, Prof. Franklyn Griffiths, Mr. Raymond Arnaudo, Dr. Heike Deggim and Dr. Peter Prokosch**)

17:00 **SESSION CLOSE BEFORE BANQUET**

19:00 **DRINKS FOLLOWED BY BANQUET IN JESUS COLLEGE, UPPER HALL (Cambridge CB5 8BL**, **www.jesus.cam.ac.uk, Tel: +44-(0)-1223-339-339)**

SPECIAL KEYNOTE ADDRESS

"Canada's Arctic Foreign Policy" – **Hon. James R. Wright**, Canadian High Commissioner, Canada

FRIDAY, 15 OCTOBER 2010
SCOTT POLAR RESEARCH INSTITUTE

08:45	**SESSION 7 (20 min presentations including questions)**
	RISKS OF CULTURAL INSTABILITIES AROUND THE ARCTIC OCEAN: Chaired by Prof. Joan Nymand Larsen, Project Manager, Arctic Human Development Report and Senior Scientist at the Stefansson Arctic Institute and University of Akureyri, Iceland
	"Impacts on Indigenous Peoples from Ecosystem Changes in the Arctic Ocean" – **Ms. Patricia Cochran**, Former Chair of the Inuit Circumpolar Council and Inupiat Eskimo from Alaska, United States
	"Impacts on Indigenous Peoples from Expanding Human Presence Around the Arctic Ocean" – **Mr. Sven-Roald Nystø**, Former President of the Norwegian Sámi Parliament (1997–2005)
09:25	**GENERAL DISCUSSION: Chaired by Prof. Joan Nymand Larsen**, Project Manager, Arctic Human Dimensions Report and Senior Scientist at the Stefansson Arctic Institute and University of Akureyri, Iceland
10:20	**COFFEE**
10:40	**SESSION 8 (20 min presentations including questions)**
	RISK MITIGATION AND ADAPTATION STRATEGIES IN THE ARCTIC OCEAN: Chaired by Dr. James McQuaid, Former Chair, Environmental Security Panel, NATO Science for Peace and Security Programme, United Kingdom
	"Governing the Arctic Ocean: What's at Stake in the Debate about an Arctic (Ocean) Treaty?" **– Prof. Oran Young**, University of California Santa Barbara and Chair of the Scientific Committee for the International Human Dimensions Programme, United States
	"Can Competent Authorities Cooperate for the Common Good: Towards A Collective Arrangement in the North-East Atlantic" – **Prof. David Johnson**, Executive Secretary for the OSPAR (Oslo and Paris Conventions for the Protection of the Marine Environment of the North-East Atlantic) Commission, United Kingdom
	"Ensuring Safe, Secure and Reliable Shipping in the Arctic Ocean" – **Dr. Heike Deggim**, Head, Marine Technology Section, Maritime Safety Division, International Maritime Organization, United Kingdom
11:40	**GENERAL DISCUSSION: Chaired by Dr. James McQuaid**, Former Chair, Environmental Security Panel, NATO Science for Peace and Security Programme, United Kingdom
12:30	**LUNCH**
13:15	**MODERATED PANEL DISCUSSION #3**
	PROMOTING COOPERATION AND PREVENTING CONFLICT IN THE CHANGING ARCTIC OCEAN: Moderated by Prof. Paul Berkman and Prof. Alexander Vylegzhanin – (Panelists: Amb. Kenneth Yalowitz, Hon. Rolf Einar Fife, Hon. Inuuteq Holm Olsen and Mr. William Eucker)
15:00	**SUMMARY DISCUSSION AND NEXT STEPS IN THIS INTERNATIONAL, INTERDISCIPLINARY AND INCLUSIVE DIALOGUE: Prof. Alexander Vylegzhanin and Prof. Paul Berkman**
15:30	**ADJOURN**

Appendix 2: Workshop Participants

NATO OTAN

This workshop is supported by: The NATO Science for Peace and Security Programme

ENVIRONMENTAL SECURITY IN THE ARCTIC OCEAN

Scott Polar Research Institute, University of Cambridge
13-15 October 2010

Scott Polar Research Institute, University of Cambridge

13–15 October 2010

Participant List

Ms. Adele Airoldi
EU-Arctic Policy Consultant
Santa Croce 2087, 30135 Venezia
Italy
adeleairoldi@hotmail.com
Tel: +39 3387 940 365

Mr. Ray Arnaudo
Member, Policy Planning Staff, Department of State
2201C Street NW, Washington, DC 20520
United States
arnaudorv@state.gov
Tel: +1 202 647 4000

Mr. Stewart Arnold
Policy Advisor to Diana Wallis (MEP)
European Parliament
PO Box 176, Brough, East Yorkshire, HU15 1UX
United Kingdom
stewartarnold@hotmail.com
Tel: +44 (0)1482 666 898
Fax: +44 (0)1482 666 898

Dr. John Ash
Institute Associate, Scott Polar Research Institute
University of Cambridge
Lensfield Road, Cambridge, CB2 1ER
United Kingdom
Jsa1003@cam.ac.uk
Tel: +44 (0)1223 336 540

Dr. Kristian Atland
Senior Analyst
Norwegian Defence Research Establishment
P.O. Box 25, Kjeller, N-2027
Norway
kristian.atland@ffi.no
Tel +47 63 80 70 00
Fax +47 63 80 71 15

Mr. Andrius Avizius
Director, Science and Technology Committee
NATO Parliamentary Assembly
Place du Petit Sablon 3, 1000 Brussels
Belgium
aavizius@nato-pa.int
Tel: +32 2 504 8141
Fax: +32 2 514 1847

Mr. Anders Backman
Chairman, TransAtlantic Ice Council
Rederi AB Transatlantic, PO Box 32, 471 21 Kinna
Sweden
Anders.backman@rabt.se
Tel: +46 (0)304409171

Prof. Paul Berkman
Head, Arctic Ocean Geopolitics Programme
Scott Polar Research Institute
University of Cambridge
Lensfield Road, Cambridge, CB2 1ER
United Kingdom
paul.berkman@spri.cam.ac.uk
berkman@bren.ucsb.edu
Cell: +44 (0)7792 983 220
Tel: +44 (0)1223 336 551
Fax: +44 (0)1223 336 549

Dr. Julie Hambrook Berkman
Managing Director, Foundation for the Good Governance of International Spaces
20 Chishill Road, Hayden, Herts, SG8 8PW
United Kingdom
jberkman@ourspaces.org.uk
Tel: +44 (0)7800 589 163

Dr. Deniz Yüksel-Beten
Head, Science for Peace and Security Section
Public Diplomacy Division
NATO Headquarters, Bd. Leopold III, 1110 Brussels
Belgium
beten.deniz@hq.nato.int
Tel.: +32 (0)2 707 4846
Fax: +32 (0)2 707 4232

Mr. Steven Bigras
Executive Director, Canadian Polar Commission
Suite 1710, Constitution Square
360 Albert Street, Ottawa, Ontario, K1R 7X7
Canada
bigrass@polarcom.gc.ca
Tel: +1 613 943 8605

Mr. Robert Blaauw
Senior Arctic Advisor
Shell International Exploration and Production BV
Carel van Bylandtlaan 16
P.O. Box 162, 2501 AN The Hague
The Netherlands
Robert.Blaauw@shell.com

Mr. Nikolaj Bock
Special Adviser on International Affairs
European Environmental Agency
Kongens Nytorv 6, Copenhagen K, DK-1050
Denmark
nikolaj.bock@eea.europa.eu
Tel: +45 3336 7100

Dr. Chad Briggs
Senior Associate, Adelphi Research
Caspar-Theyß-Straße 14, 14193 Berlin,
Germany
chad@chadmbriggs.com

Prof. Lawson Brigham
Distinguished Professor, Geography and Arctic Policy
University of Alaska Fairbanks
P.O. Box 757500, Fairbanks, AK 99775
United States
lwb48@aol.com
Tel: +1 907 474 7494

Ms. Sandra Cavalieri
Coordinator, Arctic and Transatlantic Programme
Ecologic Institute, Pfalzburger Straße 43/44
10717 Berlin
Germany
sandra.cavalieri@ecologic.eu
Tel. +49 30 868 800

Ms. Patricia Cochran
Executive Director
Alaska Native Science Commission
P.O. Box 244305, Anchorage, Alaska 99524
United States
pcochran@aknsc.org
Tel: +1 907 258 ANSC (2672)
Fax: +1 907 258 2652

Prof. David Cope
Director, Parliamentary Office of Science and Technology
UK Houses of Parliament, 7 Millbank, Westminster, London, SW1P 3JA
United Kingdom
COPED@parliament.uk
Tel: +44 (0) 20 7219 2840
Fax: +44 (0) 20 7219 2849

Dr. Robert Corell
Principal, Global Environment and Technology Foundation
2900 S. Quincy Street, Suite 375,
Arlington, VA, 22206
United States
global@dmv.com
Tel: +1 703 379 2713
Fax: +1 703 820 1815

Mr. Robert Culshaw
Deputy Director. British Antarctic Survey
Madingley Road, Cambridge, CB3 0ET
United Kingdom
rocu@bas.ac.uk
Tel: +44 (0)1223 221400

Dr. Heike Deggim
Head, Maritime Technology Section
International Maritime Organization
4 Albert Embankment, London, SE1 7SR
United Kingdom
hhoppe@imo.org
Tel +44 (0)20 7735 7611
Fax +44 (0)20 7587 3210

Mr. Duncan Depledge
Research Analyst, Climate Change and Security
Royal United Services Institute
Whitehall, London, SW1A 2ET
United Kingdom
duncand@rusi.org
Tel:+44 (0)20 7747 4967
Fax: +44 (0)20 7747 2600

Prof. Julian Dowdeswell
Director, Scott Polar Research Institute
University of Cambridge
Lensfield Road, Cambridge
CB2 1ER
United Kingdom
julian.dowdeswell@spri.cam.ac.uk
Tel: +44 (0)1223 336579
Fax: +44 (0)1223 336549

Hon. Jan Ellingsen
Member of the Norwegian Parliament;
Member of the NATO Parliamentary Assembly
Stortinget, 0026 Oslo
Norway
gae@stortinget.no
Tel: +47 23 31 30 50

Mr. Vahit Erdem
Member of Parliament (GNAT) from Kırıkkale Province
Member of the NATO Parliamentary Assembly
Turkish Grand National Assembly
Parliamentary 06543, Bakanliklar, Ministries, Ankara
Turkey
erdemvahit@gmail.com

Ms. Petra Ernstberger
Member of the NATO Parliamentary Assembly &
Member of Parliament
Deutscher Bundestag,
Plaz der Republik
11011 Berlin
Germany
petra.ernstberger@bundestag.de
Tel: +49 (0)302270

Mr. William Eucker
PhD Student, Scott Polar Research Institute
University of Cambridge, Lensfield Road,
Cambridge, CB2 1ER
United Kingdom
We217@cam.ac.uk
Tel: +44 (0)1223 336 540

Hon. Rolf Einar Fife
Director General, Legal Department
Ministry of Foreign Affairs
7. Juni-plassen/ Victoria Terrasse.
PB 8114 Dep, N-0032 Oslo
Norway
ref@mfa.no
Tel: + 47 22 24 34 00

Hon. Eva Fagerman
Counsellor, Political Affairs
Embassy of Sweden
11 Montagu Place, London
W1H 2AL
United Kingdom
eva.fagerman@foreign.ministry.se
Tel: +44 20 7917 6443

Mr. Robert Fry
Minister Councillor, Canadian High Commission
Macdonald House, 1 Grosvenor Square
London, W1K 4AB
United Kingdom
Robert.fry@international.gc.ca
Tel: +44 (0)20 7258 6600
Fax: +44 (0)20 7258 6333

Prof. Franklyn Griffiths
Professor Emeritus, Department of Political Science
Sidney Smith Hall, Room 3018
University of Toronto
100 St. George Street, Toronto, Ontario M5S 3G3
Canada
franklyn.griffiths@utoronto.ca
Tel: +1 416 978 3343

Ms. Anna Grigoryeva
Ph.D. Student, Department of Social Anthropology
University of Cambridge
Free School Lane, Cambridge CB2 3RF
United Kingdom
Ag490@cam.ac.uk

Amb. Hannu Halinen
Ambassador for Arctic Affairs
Ministry of Foreign Affairs
Merikasarmi, PO Box 176
00023 Government
Finland
Hannu.Halinen@formin.fi
Tel: +358 9 160 05

Dr. Maggy Heintz
Scientific Attache, French Embassy
6, Cromwell Place, London, SW7 2JN
United Kingdom
maggy.heintz@ambascience.co.uk
Tel: +44 (0)2070 731 392
Fax: +44 (0)2070 731 390

Prof. David Hik
President, International Arctic Science Committee
Room 2–908, Biological Sciences Building
University of Alberta, Edmonton, Alberta
Canada
dhik@ualberta.c
Tel: +1 780 492 9878
Fax: +1 780 492 0493

Prof. Paal Sigurde Hilde
Senior Fellow and Head, Security Policy Section
Norwegian Institute for Defence Studies
P.O. Box 890, Sentrum
N-0104 Oslo
Norway
paalsigurd.hilde@ifs.mil.no
Tel: +47 23 09 59 00
Fax: +47 23 09 59 65

Hon. Inuuteq Holm Olsen
Deputy Minister of Foreign Affairs
Department of Foreign Affairs
Namminersorlutik Oqartussat
Imanewq 4, Postboks 1015, 3900NUUK, Oqartussat
Greenland
inol@gh.gl
Tel: +299 34 5000
Fax: +299 32 5002

Prof. Robert Huebert
Associate Director
Centre for Military and Strategic Studies
University of Calgary
2500 University Drive, Calgary, T2N 1N4
Canada
rhuebert@ucalgary.ca
Tel: +1 403 220 3995
Fax: +1 403 282 0594

Ms. Melissa Idiens
MA (European Studies) Student
NCRE & Gateway Antarctica
University of Canterbury
Private Bag 4800, Christchurch
New Zealand
melissa.idiens@pg.canterbury.ac.nz
Tel: +64 (0)3 364 2348
Fax: +64 (0)3 364 2634

Mr. Graham Jordan
Senior Science Adviser
Royal United Services Institute
Whitehall, London, SW1A 2ET
United Kingdom
gjordan@wapshott.plus.com
Tel: +44 (0)20 7747 2600

Dr. Peter Johnson
Professor Emeritus, Department of Geography
University of Ottawa / C-CIARN North
Department of Geography, University of Ottawa
P.O. Box 450, Ottawa, ON. K1N 6N5
Canada
peterj@uottawa.ca
Tel: +1 613 824 7536

Prof. David Johnson
Executive Secretary, OPSAR Commission
New Court, 48 Carey Street
London WC2A 2JQ
United Kingdom
david.johnson@ospar.org
Tel: +44 (0)2380 319 000

Mr. Roderick Johnson
Chief Coastguard
Maritime and Coastguard Agency
Spring Place, 105 Commercial Road
Southampton, SO15 1EG
United Kingdom
rod.johnson@mcga.gov.uk
Tel: +44 (0)2380 329 486

Prof. Timo Koivurova
Director, Northern Institute for Environmental and Minority Law, Arctic Centre
University of Lapland
Lapin yliopisto PL 122, Rovaniemi, FIN-96101
Finland
timo.koivurova@ulapland.fi
Tel: +358 (0)40 551 9522
Fax: +358-16 362 934

Mr. R. Andreas Kraemer
Director, Ecologic Institute
Pfalzburger Straße 43/44, 10717 Berlin
Germany
kraemer@ecologic.eu
Tel. +49 (30) 86880-0
Fax +49 (30) 86880–100

Dr. Nicholas Langhorne
Consultant, US Office of Naval Research
United Kingdom
nlanghorne@onruk.net
Tel: +44 (0)1243 57 4044

Mr. James Macadam
PhD Student, Scott Polar Research Institute
University of Cambridge,
Lensfield Road, Cambridge, CB2 1ER
United Kingdom
jcmacadam@googlemail.com
Tel: +44 (0)1223 336 540

Mr. Terry Macalister
Energy Editor, The Guardian
Kings Place, 90 York Way, London, N1 9GU
United Kingdom
Terry.Macalister@guardian.co.uk
Tel: +44 (0)2033 532 000

Dr. Jeffery Mazo
Research Fellow, Environmental Security and Science Policy
International Institute of Strategic Studies
Arundel House, 13–15 Arundel Street,
Temple Place, London WC2R 3DX
United Kingdom
mazo@iiss.org
Tel: +44 (0)20 7379 7676
Fax: +44 (0)20 7836 3108

Dr. Jim McQuiad
Former Chair, Environmental Security Panel
NATO Science for Peace and Security Programme
61 Pingle Road, Sheffield S7 2LL
United Kingdom
jim.mcquaid@live.co.uk
Tel: +44 (0)429 373 693

Capt. Vladimir Mikhaylichenko
Executive Director
Non-commercial Partnership of the Coordination of Northern Sea Route Usages
7 Vavilova Street, The RF, Moscow 117997
Russian Federation
mihailichenkovv@mail.ru

Mr. David Monsma
Executive Director, Energy and Environment Program
The Aspen Institute, One Dupont Circle NW, Suite 700
Washington, DC 20036
United States
David.monsma@aspeninst.org
Tel: +1 202 736 2916
Fax: +1 202 467 0790

Dr. Yury Morozov
Counsellor, Science and Technology
Embassy of the Russian Federation
6–7 Kensington Palace Gardens
London W84QP
United Kingdom
science@rusemb.org.uk
Tel: +44 (0)20 7229 6412
Fax: +44 (0) 20 7727 8625

Hon. Axel Nikullasson
Counsellor, Deputy Head of Mission
Embassy of Iceland
2A Hans Street
London SW1X 0JE
United Kingdom
axel@mfa.is
Tel: +44 (0)207 259 399

Prof. Joan Nymand Larsen
Project Manager, Arctic Human Dimensions Report
Stefansson Arctic Institute
University of Akureyri, Borgir, Norðurslóð
IS-600 Akureyri
Iceland
jnl@unak.is
Tel.:+354 460 8980
Fax: +354 460 8989

Mr. Sven Roald Nystø
Former President, Norwegian Sami Parliament
M.Phil. Student, Scott Polar Research Institute
Lensfield Road, Cambridge, CB2 1ER
United Kingdom
sven.roald.nysto@gmail.comm

Mr. Brendan Plant
Ph.D. Student, Lauterpacht Centre for International Law
University of Cambridge, 10 West Road
Cambridge CB3 9DZ
United Kingdom
Bep25@cam.ac.uk

Dr. Peter Prokosch
Managing Director, UNEP/GRID-Arendal
The UN House, Teaterplassen, 3 N-4836, Arendal
Norway
peter.prokosch@grida.no
Tel: + 47 90 254755
Fax: +47 37 03 50 50

Mr. Timothy Reilly
PhD Student, Scott Polar Research Institute
University of Cambridge,
Lensfield Road, Cambridge, CB2 1ER
United Kingdom
Tbr22@cam.ac.uk
Tel: +44 (0)1223 336 540

Dr. Tatiana Saksina
Arctic Governance Officer
WWF International Arctic Programme
Avenue du Mont-Blanc 27, 1196 Gland
Switzerland
tsaksina@wwfint.org
Tel: +41 22 36 49 514

Ms. Vera Savva
Legal Department of the Council for the Study of Productive Resources
Russian Academy of Sciences
Moscow State Institute of International Relations
MGIMO University
Prospekt Vernadskogo 76, Moscow
119454
Russian Federation
Vera.savva@gmail.com

Ms. Ursula Schmidt
Member of the NATO Parliamentary Assembly
Former Federal Minister for Health and Social Security
Deutscher Bundestag
Plaz der Republik
11011 Berlin
Germany
ursula.schmidt@bundestag.de
Tel: +49 (0) 302270

Ms. Rachele Sheard
Government Relations Adviser
Shell International BV
Carel van Bylandtlaan 16
P.O. Box 162
2501 AN The Hague
The Netherlands
Rachele.j.sheard@shell.com

Dr. Olav Schram Stokke
Senior Research Fellow, Fridtjof Nansen Institute
P.O. Box 326, 1326 Lysaker
Norway
olav.s.stokke@fni.no
Tel: +47 67111900

Ms. Pamela Strigo
Policy Officer, Canadian High Commission
Macdonald House, 1 Grosvenor Square
London W1K 4AB
United Kingdom
Pamela.strigo@international.gc.ca
Tel: +44 (0)20 7258 6600
Fax: +44 (0)20 7258 6333

Prof. Alexander Vylegzhanin
Director, Legal Department of the Council for the Study of Productive Resources
Russian Academy of Sciences
Head of Department, International Law
Moscow State Institute of International Relations
MGIMO University
Prospekt Vernadskogo 76, Moscow
119454
Russian Federation
sopspravo@mail.ru
Phone/Fax: +7 495 434 9066

Prof. Peter Wadhams
Professor, Department of Applied Mathematics and Theoretical Physics
University of Cambridge
Wilberforce Road, Cambridge
CB3 0WB
United Kingdom
p.wadhams@damtp.cam.ac.uk
Tel: +44 (0)1223 760372

Hon. Diana Wallis
Vice-President for Arctic Affairs
MEP for the United Kingdom
European Parliament
PO Box 176, Brough, East Yorkshire, HU15 1UX
United Kingdom
diana.wallis@europarl.europa.eu
Tel: +44 (0)1482 666 898
Fax: +44 (0)1482 666 898

Amb. Ingo Winkelmann
Head of the Division for the Law of the Sea and the Antarctica
Federal Foreign Office
Ausdrtiges Amt, Werderscher Marktt 10117
11013 Berlin
Germany
504-rl@auswaertiges-amt.de
Tel: +49 (0)305 0000

Hon. James Wright
Canadian High Commissioner to the United Kingdom
Canadian High Commission
Macdonald House, 1 Grosvenor Square
London W1K 4AB
United Kingdom
Tel: +44 (0)20 7258 6600
Fax: +44 (0)20 7258 6333

Amb. Kenneth Yalowitz
Director, John Sloan Dickey Centre for International Understanding, Dartmouth College,
211 Silsby Hall, HB 6108, Hanover, NH 03755
United States
kenneth.s.yalowitz@dartmouth.edu
Tel: +1 603 646 2544
Fax: +1 603 646 2152

Prof. Akiko Yamanaka
Professional By-Fellow, Churchill College
University of Cambridge
Flat 8, Storey Way, Cambridge CB3 0DS
United Kingdom
Ay279@cam.ac.uk
Tel: +44 (0)1223 331 618
Fax: +44 (0)1223 336 177

Prof. Oran Young
Professor, Institutional and International Governance, and Environmental Institutions
Bren School of Environmental Science and Management
University of California, Santa Barbara, 93106
United States
young@bren.ucsb.edu
Tel: +1 805 893 8747
Fax: +1 805 893 7064

Appendix 3: *Agreement on Cooperation on Aeronautical and Maritime Search and Rescue in the Arctic/French/Russian* (Nuuk, Greenland, 12 May 2011) with Signatures

The Government of Canada, the Government of the Kingdom of Denmark, the Government of the Republic of Finland, the Government of Iceland, the Government of the Kingdom of Norway, the Government of the Russian Federation, the Government of the Kingdom of Sweden, and the Government of the United States of America, hereinafter referred to as "the Parties",

Taking into account the relevant provisions of the 1982 United Nations Convention on the Law of the Sea,

Being Parties to the 1979 International Convention on Maritime Search and Rescue, hereinafter referred to as "the SAR Convention", and the 1944 Convention on International Civil Aviation, hereinafter referred to as "the Chicago Convention",

Noting the International Aeronautical and Maritime Search and Rescue Manual, hereinafter referred to as "the IAMSAR Manual",

Recalling the 1996 Ottawa Declaration on the Establishment of the Arctic Council,

Highlighting the 2009 Tromsø Declaration on the occasion of the Sixth Ministerial Meeting of the Arctic Council, which approved the establishment of a task force to develop and complete negotiation of an international instrument on cooperation on search and rescue operations in the Arctic,

Conscious of the challenges posed by harsh Arctic conditions on search and rescue operations and the vital importance of providing rapid assistance to persons in distress in such conditions,

Mindful of the increase in aeronautical and maritime traffic and other human activity in the Arctic, including activity of Arctic residents and of people coming to the Arctic,

Recognizing the great importance of cooperation among the Parties in conducting search and rescue operations,

Emphasizing the usefulness of exchanging information and experience in the field of search and rescue and of conducting joint training and exercises,

Have agreed as follows:

Article 1

Terms and Definitions

1. For purposes of this Agreement, the terms and definitions contained in Chapter 1 of the Annex to the SAR Convention and in Chapter 1 of Annex 12 to the Chicago Convention shall apply.
2. For purposes of this Agreement, "territory of a Party" shall mean the land area of a State, its internal waters and its territorial sea, including the airspace above those areas.

Article 2

Objective of This Agreement

The objective of this Agreement is to strengthen aeronautical and maritime search and rescue cooperation and coordination in the Arctic.

Article 3

Scope of Application of This Agreement

1. The delimitations of the aeronautical and maritime search and rescue regions relevant to this Agreement are specified in paragraph 1 of the Annex to this Agreement. The area in which each Party shall apply this Agreement is set forth in paragraph 2 of the Annex to this Agreement.
2. The delimitation of search and rescue regions is not related to and shall not prejudice the delimitation of any boundary between States or their sovereignty, sovereign rights or jurisdiction.
3. Each Party shall promote the establishment, operation and maintenance of an adequate and effective search and rescue capability within its area as set forth in paragraph 2 of the Annex to this Agreement.

Article 4

Competent Authorities of the Parties

1. The Competent Authorities of the Parties are specified in Appendix I to this Agreement.
2. Each Party shall promptly inform the other Parties in writing through diplomatic channels of any changes regarding its Competent Authorities.

Article 5

Agencies Responsible for Aeronautical and Maritime Search and Rescue

1. The agencies responsible for aeronautical and maritime search and rescue, hereinafter referred to as "search and rescue agencies", are specified in Appendix II to this Agreement.
2. Each Party, through its Competent Authorities, shall promptly inform the other Parties of any changes regarding its search and rescue agency or agencies.

Article 6

Rescue Coordination Centers

1. The list of aeronautical and/or maritime rescue coordination centers, hereinafter referred to as "RCCs", of the Parties for the purposes of this Agreement is contained in Appendix III to this Agreement.
2. Each Party, through its Competent Authorities, shall promptly inform the other Parties of any changes regarding its RCCs.

Article 7

Conduct of Aeronautical and Maritime Search and Rescue Operations

1. The SAR Convention and the Chicago Convention shall be used as the basis for conducting search and rescue operations under this Agreement.
2. The IAMSAR Manual provides additional guidelines for implementing this Agreement.
3. Without prejudice to paragraph 1 of this Article, the Parties shall conduct aeronautical and maritime search and rescue operations pursuant to this Agreement consistent with the following:

   (a) search and rescue operations conducted pursuant to this Agreement in the territory of a Party shall be carried out consistent with the laws and regulations of that Party;
   (b) if a search and rescue agency and/or RCC of a Party receives information that any person is, or appears to be, in distress, that Party shall take urgent steps to ensure that the necessary assistance is provided;
   (c) any Party having reason to believe that a person, a vessel or other craft or aircraft is in a state of emergency in the area of another Party as set forth in paragraph 2 of the Annex shall forward as soon as possible all available information to the Party or Parties concerned;
   (d) the search and rescue agency and/or RCC of a Party that has received information concerning a situation provided for in subparagraph (b) of this paragraph may request assistance from the other Parties;
   (e) the Party to whom a request for assistance is submitted shall promptly decide on and inform the requesting Party whether or not it is in a position to render the assistance requested and shall promptly indicate the scope and the terms of the assistance that can be rendered;
   (f) the Parties shall ensure that assistance be provided to any person in distress. They shall do so regardless of the nationality or status of such a person or the circumstances in which that person is found; and
   (g) a Party shall promptly provide all relevant information regarding the search and rescue of any person to the consular or diplomatic authorities concerned.

Article 8

Request to Enter the Territory of a Party for Purposes of Search and Rescue Operations

1. A Party requesting permission to enter the territory of a Party or Parties for search and rescue purposes, including for refueling, shall send its request to a search and rescue agency and/or RCC of the relevant Party or Parties.
2. The Party receiving such a request shall immediately confirm such receipt. The receiving Party, through its RCCs, shall advise as soon as possible as to whether entry into its territory has been permitted and the conditions, if any, under which the mission may be undertaken.
3. The Party receiving such a request, as well as any Party through whose territory permission to transit is needed, shall apply, in accordance with its law and international obligations, the most expeditious border crossing procedure possible.

Article 9

Cooperation Among the Parties

1. The Parties shall enhance cooperation among themselves in matters relevant to this Agreement.
2. The Parties shall exchange information that may serve to improve the effectiveness of search and rescue operations. This may include, but is not limited to:

   (a) communication details;
   (b) information about search and rescue facilities;
   (c) lists of available airfields and ports and their refueling and resupply capabilities;
   (d) knowledge of fueling, supply and
   (e) information useful for training search and rescue personnel.

3. The Parties shall promote mutual search and rescue cooperation by giving due consideration to collaborative efforts including, but not limited to:

   (a) exchange of experience;
   (b) sharing of real-time meteorological and oceanographic observations, analyses, forecasts, and warnings;
   (c) arranging exchanges of visits between search and rescue personnel;
   (d) carrying out joint search and rescue exercises and training;
   (e) using ship reporting systems for search and rescue purposes;
   (f) sharing information systems, search and rescue procedures, techniques, equipment, and facilities;
   (g) providing services in support of search and rescue operations;
   (h) sharing national positions on search and rescue issues of mutual interest within the scope of this Agreement;

(i) supporting and implementing joint research and development initiatives aimed, inter alia, at reducing search time, improving rescue effectiveness, and minimizing risk to search and rescue personnel; and
(j) conducting regular communications checks and exercises, including the use of alternative means of communications for handling communication overloads during major search and rescue operations.

4. When conducting joint exercises, the Parties should apply the principles of this Agreement to the extent possible.

Article 10

Meetings of the Parties

The Parties shall meet on a regular basis in order to consider and resolve issues regarding practical cooperation. At these meetings they should consider issues including but not limited to:

(a) reciprocal visits by search and rescue experts;
(b) conducting joint search and rescue exercises and training;
(c) possible participation of search and rescue experts as observers at national search and rescue exercises of any other Party;
(d) preparation of proposals for the development of cooperation under this Agreement;
(e) planning, development, and use of communication systems;
(f) mechanisms to review and, where necessary, improve the application of international guidelines to issues concerning search and rescue in the Arctic; and
(g) review of relevant guidance on Arctic meteorological services.

Article 11

Joint Review of Search and Rescue Operations

After a major joint search and rescue operation, the search and rescue agencies of the Parties may conduct a joint review of the operation led by the Party that coordinated the operation.

Article 12

Funding

1. Unless otherwise agreed, each Party shall bear its own costs deriving from its implementation of this Agreement.

2. Implementation of this Agreement shall be subject to the availability of relevant resources.

Article 13

Annex

The Annex to this Agreement forms an integral part of this Agreement. All references to this Agreement are understood to include the Annex.

Article 14

Amendments

1. 1.This Agreement may be amended by written agreement of all the Parties.
2. An amendment shall enter into force 120 days after the date on which the depositary has received the last written notification through diplomatic channels that the Parties have completed the internal procedures required for its entry into force.

Article 15

Amendment Procedure for the Annex

1. Notwithstanding Article 14 of this Agreement, any two Parties with adjacent search and rescue regions may by mutual agreement amend information contained in paragraph 1 of the Annex to this Agreement setting forth the delimitation between those regions. Such amendment shall enter into force 120 days after the date on which the depositary has received confirmation through diplomatic channels from both Parties that such mutual agreement has entered into force.
2. Notwithstanding Article 14 of this Agreement, any Party may amend that portion of paragraph 2 of the Annex to this Agreement that does not affect the area of any other Party and shall notify the depositary of any such amendment through diplomatic channels. Such amendment shall enter into force 120 days after the date of such notification.

Article 16

Relationship with Other Agreements

With the exception of paragraph 1 of the Annex to this Agreement, the provisions of this Agreement shall not affect the rights and obligations of Parties under agreements between them which are in force on the date of the entry into force of this Agreement.

Article 17

Settlement of Disputes

The Parties shall resolve any disputes concerning the application or interpretation of this Agreement through direct negotiations.

Article 18

Non-Parties

Any Party to this Agreement may, where appropriate, seek cooperation with States not party to this Agreement that may be able to contribute to the conduct of search and rescue operations, consistent with existing international agreements.

Article 19

Provisional Application, Entry into Force and Withdrawal

1. This Agreement may be applied provisionally by any signatory that provides a written statement to the depositary of its intention to do so. Any such signatory shall apply this Agreement provisionally from the date of its statement or from such other date as indicated in its statement.
2. This Agreement shall enter into force 30 days after the date of receipt by the depositary of the last written notification through diplomatic channels that the Parties have completed the internal procedures required for its entry into force.
3. Any Party may at any time withdraw from this Agreement by sending written notification thereof to the depositary through diplomatic channels at least 6 months in advance, specifying the effective date of its withdrawal. Withdrawal from this Agreement shall not affect its application among the remaining Parties.

Article 20

Depositary

The Government of Canada shall be the depositary for this Agreement.

DONE at *Nuuk* this *12th* day of *May* 2011, in the English, French and Russian languages, all texts being equally authentic. The working language of this Agreement shall be English, the language in which this Agreement was negotiated.

Annex

Scope of Application of This Agreement (See Fig. A.1)

1. The search and rescue regions relevant to this Agreement are delimited as follows: [1]

Canada – Denmark

The aeronautical and maritime search and rescue regions of Canada and Denmark shall be delimited by a continuous line connecting the following coordinates:

- 58°30′00″N, 043°00′00″W;
- 58°30′00″N, 050°00′00″W;
- 63°00′00″N, 055°40′00″W;
- 65°00′00″N, 057°45′00″W;
- 76°00′00″N, 076°00′00″W;
- 78°00′00″N, 075°00′00″W;
- 82°00′00″N, 060°00′00″W; and
- Thence north to the North Pole.

Canada – United States of America

The aeronautical and maritime search and rescue regions of Canada and the United States of America shall be delimited by a continuous line connecting the following coordinates:

- 48°20′00″N, 145°00′00″W;
- 54°40′00″N, 140°00′00″W;
- 54°40′00″N, 136°00′00″W;
- 54°00′00″N, 136°00′00″W;
- 54°13′00″N, 134°57′00″W;
- 54°39′27″N, 132°41′00″W;
- 54°42′30″N, 130°36′30″W; and
- North along the land border to the Beaufort Sea and thence to the North Pole.

Denmark – Iceland

The aeronautical and maritime search and rescue regions of Denmark and Iceland shall be delimited by a continuous line connecting the following coordinates:

- 58°30′00″N, 043°00′00″W;
- 63°30′00″N, 039°00′00″W;
- 70°00′00″N, 020°00′00″W;
- 73°00′00″N, 020°00′00″W; and
- 73°00′00″N, 000°00′00″E/W.

[1] The coordinates in this Annex use the World Geodetic System 1984 (“WGS 84”). All coordinates are connected by geodetic lines. The North Pole refers to the Geographic North Pole, located at 90° North latitude, and the Arctic Circle refers to 66°33′44″N latitude.

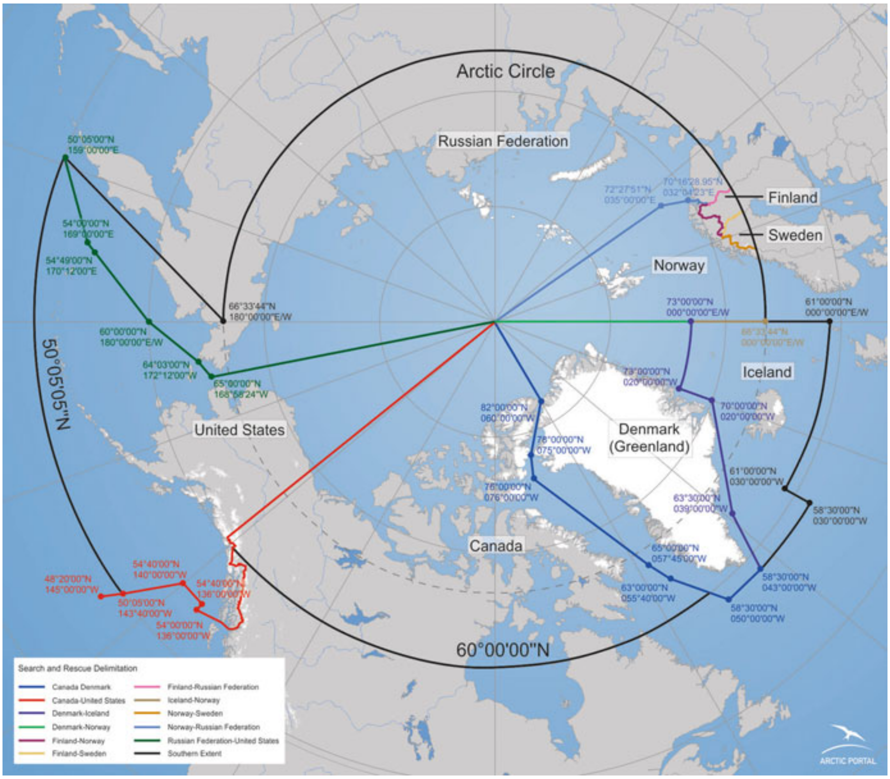

Fig. A.1 Search-and-rescue areas of application among the eight Arctic states surrounding the Arctic Ocean derived from the Annex of the *"Agreement on Cooperation on Aeronautical and Maritime Search and Rescue in the Arctic"* that was signed during the Arctic Council ministerial meeting in Nuuk, Greenland, on 12 May 2011. This was the first pan-Arctic agreement signed by all eight Arctic states. This map is from the Arctic Council (http://library.arcticportal.org/1474/11/search-rescue_ensku_110524_minnka.jpg. Accessed 10 July 2012)

Denmark – Norway

The aeronautical and maritime search and rescue regions of Denmark and Norway shall be delimited by a continuous line connecting the following coordinates:

- 73°00′00″N, 000°00′00″E/W; and
- Thence north to the North Pole.

Finland – Norway

The land border between Finland and Norway shall be the limit of their respective search and rescue regions.

Finland – Sweden

The land border between Finland and Sweden shall be the limit of their respective search and rescue regions.

Finland – Russian Federation

The land border between Finland and the Russian Federation shall be the limit of their respective search and rescue regions.

Iceland – Norway

The aeronautical and maritime search and rescue regions of Iceland and Norway shall be delimited by a continuous line connecting the following coordinates:

- 66°33′44″N, 000°00′00″E/W; and
- 73°00′00″N, 000°00′00″E/W.

Norway – Sweden

The land border between Norway and Sweden shall be the limit of their respective search and rescue regions.

Norway – Russian Federation

The aeronautical and maritime search and rescue regions of Norway and the Russian Federation shall be delimited by the land border between Norway and the Russian Federation and then by a continuous line connecting the following coordinates:

- 69°47′41.42″N, 030°49′03.55″E;
- 69°58′45.49″N, 031°06′15.58″E;
- 70°05′58.84″N, 031°26′41.28″E;
- 70°07′15.20″N, 031°30′19.43″E;
- 70°11′51.68″N, 031°46′33.57″E;
- 70°16′28.95″N, 032°04′23.00″E;
- 72°27′51.00″N, 035°00′00.00″E; and
- Thence to the North Pole.

Russian Federation – United States of America

The aeronautical and maritime search and rescue regions of the Russian Federation and the United States of America shall be delimited by a continuous line connecting the following coordinates:

- 50°05′00″N, 159°00′00″E;
- 54°00′00″N, 169°00′00″E;
- 54°49′00″N, 170°12′00″E;
- 60°00′00″N, 180°00′00″E/W;
- 64°03′00″N, 172°12′00″W;
- 65°00′00″N, 168°58′24″W; and
- Thence north to the North Pole.

2. Each Party shall apply this Agreement in the following areas as encompassed by a continuous line, respectively:

Canada

- From the North Pole south to 82°00′00″N, 060°00′00″W;
- 78°00′00″N, 075°00′00″W;
- 76°00′00″N, 076°00′00″W;
- 65°00′00″N, 057°45′00″W;

- 63°00′00″N, 055°40′00″W;
- To the point where it intersects 60°00′00″N latitude;
- West along 60°00′00″N latitude until it intersects with land border between Canada and the United States of America;
- North along the land border to the Beaufort Sea; and
- Thence north to the North Pole.

Denmark

- From the North Pole south to 82°00′00″N, 060°00′00″W;
- 78°00′00″N, 075°00′00″W;
- 76°00′00″N, 076°00′00″W;
- 65°00′00″N, 057°45′00″W;
- 63°00′00″N, 055°40′00″W;
- 58°30′00″N, 050°00′00″W;
- 58°30′00″N, 043°00′00″W;
- 63°30′00″N, 039°00′00″W;
- 70°00′00″N, 020°00′00″W;
- 73°00′00″N, 020°00′00″W;
- 73°00′00″N, 000°00′00″E/W; and
- Thence north to the North Pole.

Finland

- From the tripoint at which the land borders of Finland, Norway and Sweden meet, south along the land border between Finland and Sweden to the point a which that border intersects the Arctic Circle;
- East along the Arctic Circle to the point at which the land border between Finland and the Russian Federation;
- North along the land border between Finland and the Russian the tripoint at which the land borders of Finland, Norway and the Russian Federation meet; and
- Thence to the tripoint at which the land borders of Finland, Norway and Sweden meet.

Iceland

- From 73°00′00″N, 000°00′00″E/W west to 73°00′00″N, 020°00′00″W;
- 70°00′00″N, 020°00′00″W;
- 63°30′00″N, 039°00′00″W;
- 58°30′00″N, 043°00′00″W;
- 58°30′00″N, 030°00′00″W;
- 61°00′00″N, 030°00′00″W;
- 61°00′00″N, 000°00′00″E/W
- Thence north to 73°00′00″N, 000°0

Norway

- From the North Pole south to 66°33′44″N, 000°00′00″E/W;
- East along the Arctic Circle to the point at which the Arctic Circle intersects the land border between Sweden and Norway;

- North along the land border between Sweden and Norway to the tripoint at which the land borders of Sweden, Norway and Finland meet;
- East along the land border between Finland and Norway to the tripoint at which the land borders of Finland, Norway and the Russian Federation meet;
- North along the land border to the Barents Sea;
- 69°47′41.42″N, 030°49′03.55″E;
- 69°58′45.49″N, 031°06′15.58″E;
- 70°05′58.84″N, 031°26′41.28″E;
- 70°07′15.20″N, 031°30′19.43″E;
- 70°11′51.68″N, 031°46′33.57″E;
- 70°16′28.95″N, 032°04′23.00″E;
- 72°27′51.00″N, 035°00′00.00″E; and
- Thence north to the North Pole.

Russian Federation

- From the North Pole south to 72°27′51.00″N, 035°00′00.00″E;
- 70°16′28.95″N, 032°04′23.00″E;
- 70°11′51.68″N, 031°46′33.57″E;
- 70°07′15.20″N, 031°30′19.43″E;
- 70°05′58.84″N, 031°26′41.28″E;
- 69°58′45.49″N, 031°06′15.58″E;
- 69°47′41.42″N, 030°49′03.55″E south to the point at which that meridian meets the land border between the Russian Federation and Norway;
- South along the land border between the Russian Federation and Nor the tripoint at which the land borders of the Russian Federation, Finland and Norway meet;
- South along the land border between the Russian Federation and Finland to the point at which that border intersects the Arctic Circle;
- East along the Arctic Circle until the Arctic Circle intersects the 180°00′00″E/W meridian;
- 50°05′00″N, 159°00′00″E;
- 54°00′00″N, 169°00′00″E;
- 54°49′00″N, 170°12′00″E;
- 60°00′00″N, 180°00′00″E/W
- 64°03′00″N, 172°12′00″W;
- 65°00′00″N, 168°58′24″W; and
- Thence north to the North Pole.

Sweden

- From the tripoint at which the land borders of Sweden, Norway and Finland meet;
- South along the land border between Sweden and Norway to the point at which that border intersects the Arctic Circle;
- East along the Arctic Circle to the point at which the Arctic Circle intersects the land border between Sweden and Finland; and
- Thence North along the land border between Sweden and Finland to the tripoint at which the land borders of Sweden, Norway and Finland meet.

United States of America

- From the North Pole south to 65°00′00″N, 168°58′24″W;
- 64°03′00″N, 172°12′00″W;
- 60°00′00″N, 180°00′00″E/W;
- 54°49′00″N, 170°12′00″E;
- 54°00′00″N, 169°00′00″E;
- 50°05′00″N, 159°00′00″E;
- 50°05′00″N, 143°40′00″W;
- 54°40′00″N, 140°00′00″W;
- 54°40′00″N, 136°00′00″W;
- 54°00′00″N, 136°00′00″W;
- 54°13′00″N, 134°57′00″W;
- 54°39′27″N, 132°41′00″W;
- 54°42′30″N, 130°36′30″W;
- North along the land border to the Beaufort Sea; and
- Thence north to the North Pole.

Appendix I

Competent Authorities

The Competent Authorities of the Parties are:
Canada – Minister of National Defence;
Denmark – Danish Maritime Authority;
Finland –Ministry of the Interior; Finnish Transport Safety Agency;
Iceland –Ministry of the Interior;
Norway –Ministry of Justice and the Police;
Russian Federation – Ministry of Transport of the Russian Federation; Ministry of the Russian Federation for Civil Defense, Emergency and Elimination of Consequences of Natural Disasters;
Sweden – Swedish Maritime Administration; and
United States of America – United States Coast Guard.

Appendix II

Search and Rescue Agencies

The search and rescue agencies of the Parties are:
Canada – Canadian Forces; Canadian Coast Guard;
Denmark – Danish Maritime Authority, Danish Transport Authority, Ministry of
Fisheries – Faroe Islands;
Finland – Finnish Border Guard;
Iceland – Icelandic Coast Guard;
Norway – Joint Rescue Coordination Centre, Northern Norway (JRCC NN Bodø);

Russian Federation – Federal Air Transport Agency; Federal Agency for Marine and River Transport;
Sweden – Swedish Maritime Administration; and
United States of America – United States Coast Guard; United States Department of Defense.

Appendix III

Rescue Coordination Centers

The rescue coordination centers of the Parties are:
Canada – Joint Rescue Coordination Centre, Trenton;
Denmark – Maritime Rescue Coordination Center Grønnedal (MRCC Grønnedal); Rescue Coordination Center Søndrestrøm/Kangerlussuaq (RCC Søndrestrøm); Maritime Rescue and Coordination Center Torshavn (MRCC Torshavn);
Finland – Maritime Rescue Coordination Centre Turku (MRCC Turku); Aeronautical Rescue Coordination Centre Finland (ARCC Finland);
Iceland – Joint Rescue Coordination Center Iceland (JRCC Iceland);
Norway – Joint Rescue Coordination Centre, Northern Norway (JRCC NN Bodø);
Russian Federation – State Maritime Rescue Coordination Center (SMRCC); Main Aviation Coordination Center for Search and Rescue (MACC);
Sweden – Joint Rescue Coordination Center Gothenburg (JRCC Gothenburg); and
United States of America – Joint Rescue Coordination Center Juneau (JRCC Juneau); Aviation Rescue Coordination Center Elmendorf (ARCC Elmendorf).

For the Government of Canada

Pour le Gouvernement du Canada

За Правительство Канады

For the Government of the Kingdom of Denmark, together with the Government of the Faroe Islands and the Government of Greenland

Pour le Gouvernement du Royaume de Danemark, ainsi que pour le Gouvernement des Îles Féroé et le Gouvernement du Groenland

За Правительство Королевства Дания, совместно с Правительством Гренландии и Правительством Фарерских Островов

For the Government of the Faroe Islands

Pour le Gouvernement des Îles Féroé

За Правительство Гренландии

For the Government of Greenland

Pour le Gouvernement du Groenland

За Правительство Фарерских Островов

For the Government of the Republic of Finland
Pour le Gouvernement de la République de Finlande
За Правительство Финляндской Республики

For the Government of Iceland
Pour le Gouvernement de l'Islande
За Правительство Исландии

For the Government of the Kingdom of Norway
Pour le Gouvernement du Royaume de Norvège
За Правительство Королевства Норвегия

For the Government of the Russian Federation

Pour le Gouvernement de la Fédération de Russie

За Правительство Российской Федерации

For the Government of the Kingdom of Sweden

Pour le Gouvernement du Royaume de Suède

За Правительство Королевства Швеция

For the Government of the United States of America

Pour le Gouvernement des États-Unis d'Amérique

За Правительство Соединенных Штатов Америки

Hillary Rodham Clinton

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