2015
North Pacific Arctic Conference Proceedings

The Arctic in World Affairs

A North Pacific Dialogue on the Arctic in the Wider World

Edited by

Oran R. Young
Jong Deog Kim
Yoon Hyung Kim

KOREA MARITIME INSTITUTE

EAST-WEST CENTER
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KMI/EWC SERIES ON THE ARCTIC IN WORLD AFFAIRS

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The first volume in the series, *A North Pacific Dialogue on Arctic Transformation*, based on the 2011 North Pacific Artic Conference, was edited by Robert W. Corell, James Seong-Cheol Kang, and Yoon Hyung Kim.

The second volume, *A North Pacific Dialogue on Arctic Marine Issues*, from the 2012 conference, was edited by Oran R. Young, Jong Deog Kim, and Yoon Hyung Kim.

The third volume, *A North Pacific Dialogue on the Future of the Arctic*, from the 2013 conference, was edited by Oran R. Young, Jong Deog Kim, and Yoon Hyung Kim.

The forth, *A North Pacific Dialogue on International Cooperation in a Changing Arctic*, from the 2014 conference, was edited by Oran R. Young, Jong Deog Kim, and Yoon Hyung Kim.

The volume, *A North Pacific Dialogue on the Arctic in the Wider World*, from the 2015 conference, was edited by Oran R. Young, Jong Deog Kim, and Yoon Hyung Kim.

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Preface

We cannot predict the course of events in the Arctic over the next ten to twenty years. But we do know that events occurring on a global scale, ranging from trends in emissions of greenhouse gases to shifts in world market prices for oil, will play decisive roles regarding what happens in the circumpolar North. The Arctic may become a key region of the world in geopolitical and global economic terms. On the other hand, it is possible that the current interest in the region may seem like a short-lived phenomenon from the perspective of 2030 or even 2025. In focusing on "The Arctic in the Wider World," the 2015 North Pacific Arctic Conference (NPAC) directed attention to global trends, seeking to illuminate the forces that will drive the policies of the six major North Pacific states regarding Arctic affairs and consequently determine whether the region continues to occupy the attention of senior policymakers in these states.

Under these circumstances, the U.S. Chairmanship of the Arctic Council, which began on 24 April 2015, has emerged as a focus of high-level policy interest. In preparation for taking over the chair from Canada at the Iqaluit Ministerial, the United States appointed a high-level policy advisor on Arctic issues, created an Arctic Executive Steering Committee in the Executive Office of the President, increased the size of the staff dealing with Arctic issues in the State Department, and devoted considerable effort to articulating a set of policy priorities for its chairmanship during 2015–17. The United States described the overall theme for its chairmanship as "One Arctic: Shared Opportunities, Challenges, and Responsibilities" and identified three substantive themes: addressing the impacts of climate change in the Arctic, stewardship of the Arctic Ocean, and improving economic and living conditions in the Arctic. The efforts undertaken during the U.S. Chairmanship, together with those of Finland during its turn as Arctic Council chair during 2017–19, are likely to make a considerable difference in determining whether the Arctic remains a zone of peace and prosperity. The materials included in this book explore issues pertaining to the implementation of the U.S. Arctic Council Chairmanship program as well as responses to this agenda on the part of both Arctic and non-Arctic states.

Cooperation among the council's major participants is vital to the effectiveness of the Arctic Council. Many fear that rising tensions between Russia and the West, focused currently on the conflict in Ukraine and the civil war in Syria but arising from Russia's renewed assertiveness as a great power, will disrupt cooperation regarding Arctic issues. But this need not be the case. There are few areas where Russia's interests in the circumpolar North are at variance with those of the United States and the other Arctic states. The primary issues on the council's agenda in the coming years feature environmental protection and sustainable development where the interests of all the council's members are largely compatible. These include safety of navigation in the Arctic Ocean, the prevention of oil spills, the application of business models for economic development that empower and meet the needs of Arctic communities, the establishment of new programs for improved healthcare and education in the Arctic, and prudent management of fish and marine mammal stocks. The members of the council also face issues of governance involving questions such as clarifying the roles of observer states, whether or not to add classic security issues to the council's agenda, and the negotiation of additional binding agreements under the auspices of the council. In all these matters, the major Arctic Council players have strong interests in finding ways to preserve the constructive, consensual nature of council operations. The contributions to this book examine these issues from a number of perspectives, probing their importance for the future of the Arctic in the process.

The 2015 North Pacific Arctic Conference was organized by the East-West Center and the Korea Maritime Institute and held in Honolulu, Hawai'i, in August 2015. This provided an opportunity for informal dialogue among knowledgeable individuals on the impacts of global economic and political forces on Arctic international relations, with an emphasis on relations among China, Japan, and Korea as key non-Arctic states and Canada, Russia, and the United States as major Arctic states. The conference also explored transformative changes occurring in the Arctic that have major socioeconomic and geopolitical implications for the nations and peoples of the North Pacific region and the needs for governance associated with these changes. Participants considered ways to preserve the Arctic as a zone of peace and prosperity in an era of global change.

The chapters and commentaries included in the book are based on presentations made at the conference. The opening chapter seeks to capture the main themes and to set the entire discussion in a broader context. We would like to thank Dr. Oran R. Young, professor emeritus at the University of California, Santa Barbara; Dr. Jong Deog Kim, research fellow at the Korea Maritime Institute; and Dr. Yoon Hyung Kim, professor emeritus at the Hankuk University of Foreign Studies and senior fellow at the East-West Center, for coordinating the conference and preparing this volume for publication. We also wish to thank the paper writers, commentators, and others involved in contributing to the success of this conference. We are grateful to Dr. Nancy Lewis at the East-West Center for her support of the NPAC program. Our sincere gratitude goes to June Kuramoto of the East-West Center for her expert management of the conference logistics.

Sung Gwi Kim	Charles E. Morrison
President	President
Korea Maritime Institute	East-West Center

THE ARCTIC IN THE WIDER WORLD: INTRODUCTION AND OVERVIEW

1. The Arctic in the Wider World: Introduction and Overview[1]

Yoon Hyung Kim, Oran R. Young, and Jong Deog Kim

BACKGROUND

Recent environmental, economic, and geopolitical developments are tightening the connections between the Arctic region and the wider world. The impacts of climate change are unfolding more rapidly and more dramatically in the Arctic than in any other part of the planet. One of these impacts, an unexpected collapse in Arctic sea ice starting in 2007, has triggered rising expectations about the accessibility of the Arctic for purposes of energy development and commercial navigation. At the same time, geopolitical developments, including rising tensions between Russia and the West over developments in Ukraine and Syria along with the emergence of China as a global power, have raised concerns about the maintenance of the Arctic as a zone of peace.

The resultant globalization of the Arctic has triggered a sharp rise in interest in the Arctic in many quarters. Some see the Arctic as a new hub of globally significant economic developments. Others foresee a scramble for Arctic resources that could heighten tensions in the region, leading eventually to "resource wars" and even armed clashes. Still others focus on the environmental impacts of Arctic development in such forms as large-scale oil spills under severe Arctic conditions and the destruction of fragile Arctic ecosystems resulting from a dramatic increase in commercial navigation using Arctic sea routes.

Yet it is by no means clear that these fears are realistic. Arctic hydrocarbons are abundant but expensive to extract and transport to southern markets. The recent drop in world oil prices is likely to make many Arctic reserves uneconomical. Already, both private companies and state-owned enterprises are setting aside plans for development in the region. In practice, Arctic shipping routes and especially the Northern Sea Route (NSR) are much less attractive than they look on paper. The year 2014 witnessed a decline in commercial ship traffic in the NSR. Russian initiatives to strengthen the Northern Fleet based on the Kola Peninsula and to reoccupy several military bases abandoned after the collapse of the Soviet Union are interpreted by some observers as an indication of renewed militarization of the Arctic. But others see these moves as routine initiatives that should not be treated as a cause for concern.

The future of the Arctic over the next ten to twenty years is therefore ambiguous. What we do know is that events occurring on a global scale, ranging from trends in emissions of greenhouse gases to shifts in world market prices for oil, will play decisive roles regarding what happens in the circumpolar North. The Arctic may take its place as a key region of the world in geopolitical and global economic terms. On the other hand, global interest in the region may recede with the passage of time. It is possible that the current interest in the region may seem like a short-lived phenomenon from the perspective of 2030 or even 2025. In focusing on "The Arctic in the Wider World," the 2015 North Pacific Arctic Conference (NPAC 2015) directed attention to this topic, seeking to illuminate the forces that will drive the policies of the six major North Pacific states regarding Arctic affairs and consequently determine whether the region continues to occupy the attention of senior policymakers in these states.

Under these circumstances, the U.S. Chairmanship of the Arctic Council (AC), which began on 24 April 2015, has emerged as a focus of high-level policy interest. In preparation for taking over the chair from Canada at the ministerial meeting in Iqaluit, the United States appointed a high-level policy advisor on Arctic issues, created an Arctic Executive Steering Committee in the Executive Office of the President, increased the size of the staff dealing with Arctic issues in the Department of State, and devoted considerable effort to articulating a set of policy priorities for its 2015–17 chairmanship. The United States announced as an overall theme for its chairmanship "One Arctic: Shared Opportunities, Challenges, and Responsibilities." Under this rubric, the government identified three substantive themes: (1) addressing the impacts of climate change in the Arctic, (2) enhancing stewardship of the Arctic Ocean, and (3) improving economic and living conditions in the Arctic. The efforts undertaken during the U.S. Chairmanship, together with those of the Finnish chairmanship to follow in 2017–19, are likely to make a considerable difference in determining whether the Arctic remains a zone of peace and prosperity. Materials included in this book explore issues pertaining to the U.S. Arctic Council Chairmanship program and the range of Arctic-state/non-Arctic-state responses to this agenda.

Cooperation among the council's major participants is vital to the effectiveness of the Arctic Council. It is understandable that many fear that rising tensions between Russia and the West, focused currently on the conflicts in Ukraine and Syria but arising from Russia's renewed assertiveness as a great power, will disrupt cooperation regarding Arctic issues. But this need not be the case. There are few areas where Russia's interests in this region are at variance with those of the United States and other Arctic states. The primary issues on the council's agenda in the coming years are those dealing with environmental protection and sustainable development—where all the council's members have more in common than not: safety of navigation in the Arctic Ocean, the prevention of oil spills, the application of business models for economic development that empower and meet the needs of Arctic communities, establishing new programs for improved healthcare and education in the Arctic, and prudent management of fish and marine mammal stocks. The members of the council also face governance questions including clarifying the roles of observer states, whether classic security issues should be added to the list of subjects for council discussion, and the nature of additional binding agreements developed under the auspices of the council. In all these matters, the major Arctic Council players have strong interests in finding common cause to preserve the constructive, consensual nature of council operations. This book attempts to address some of these questions, probing their importance for the future of the Arctic in the process.

The book comprises six parts. Part I contains one chapter and five commentaries examining the Arctic agenda. Part II contains one chapter and five international perspectives on policy implications of climate change for the nations with Arctic interests. Part III presents six interdisciplinary perspectives on the implementation of the Polar Code. The one chapter and four commentaries in part IV address the impacts of shifting world energy markets on Arctic resource development. Part V contains one chapter and four commentaries on Arctic Ocean stewardship. The three indigenous perspectives and two academic commentaries in part VI address how to improve living conditions in the Arctic. A brief conclusion identifies future directions in the ongoing dialogue on these topics.

PART I: THE ARCTIC AGENDA

In chapter 2, "The U.S. Arctic Council Chairmanship," Julia L. Gourley speaking in her capacity as the U.S. senior arctic official begins with a discussion of the boundaries of the Arctic set out in the U.S. Arctic Research and Policy Act of 1984. The U.S. Arctic includes the Bering Sea, areas of the Aleutians, and parts of Alaska that are not strictly Arctic. The Arctic Circle provides the basis for determining the membership of the Arctic Council. According to Gourley, priority themes of the U.S. Chairmanship are: (1) Healthy Arctic Communities, (2) Arctic Climate Change, and (3) Arctic Ocean Stewardship. Key messages are that the Arctic is a region of stability, peace, and international cooperation and that the impacts of Arctic climate change are local, regional, and global. Gourley then reviews recent Arctic diplomacy chronologically:

- Arctic Environmental Protection Strategy launched in 1991;
- Arctic Council established in 1996 by Ottawa Declaration;
- the Arctic becomes increasingly important worldwide; all eight Arctic states and a number of non-Arctic states now have Arctic policies and strategies;
- the United States adopted the 2009 Arctic Region Policy and the 2013 National Strategy for the Arctic Region. A 2015 executive order seeks to coordinate arctic policy in the executive branch among departments and agencies; and
- the United States appointed its first-ever special representative for the Arctic region in July 2014.

Turning to the Arctic Council, Gourley emphasizes that the council is a high-level forum, not an intergovernmental organization. A permanent secretariat is located in Tromsø, Norway. The Arctic Council's mandate focuses on environmental protection and sustainable development. It does not cover military security issues. The Arctic Council has a generative role in building trust, identifying issues, creating networks, and producing innovative ideas. This is particularly evident in the activities of the working groups. During its chairmanship, the United States will seek to: (1) strengthen the AC, (2) introduce long-term priorities, and (3) increase awareness regarding climate change.

Participants in the work of the council are the eight Arctic member states who make decisions by consensus, six permanent participants, twelve observer countries, eleven nongovernmental organizations, and nine intergovernmental and interparliamentary organizations. Six working groups and (currently) three task forces conduct the detailed work of the council. Task forces in the Arctic Council are temporary teams created to do practical work requiring high-level attention. Under the U.S. Chairmanship, task forces include: (1) the Task Force on Arctic Marine Cooperation to discuss a regional seas agreement or other ways to manage the opening Arctic Ocean; (2) the Task Force on Telecommunications Infrastructure in the Arctic to determine what is needed to build a modern telecom system; and (3) the Scientific Cooperation Task Force to conduct negotiations on a legally binding agreement not to set research agendas, but to guide how scientists deal with Arctic samples and related materials and how scientists gain access to specific areas to conduct research.

The AC's role has grown and changed and it now needs to find better ways to manage relations with the non-Arctic world. With the acceptance of five Asian states in 2013, the council now has a total of thirty-two observers. The council is engaged in serious discussion about the inclusion of additional observers. The United States seeks to bring clarity and finality to this discussion. As a general principle, the AC needs to become a more open system.

In commenting on the U.S. Arctic Council Chairmanship from an Arctic-state policy perspective, Hugi Ólafsson argues that there is a clear need for dialogue among Arctic, near-Arctic, and non-Arctic states.

A short anecdote: during the presentation of the *Arctic Climate Impact Assessment (ACIA)* report at a United Nations Framework Convention on Climate Change (UNFCCC) meeting, the first response was from Bangladesh. The Bangladeshi representative was visibly shaken. Sea level rise caused by the melting of the Greenland ice sheet will be critically important for Bangladesh because most of the country is below or just slightly above the current sea level.

The Arctic story has to get out to the world. The Arctic agenda is not just the Arctic Council's agenda, but the council is a good place to start because it is at the center of Arctic affairs. The priorities of the U.S. Chairmanship are spot-on and will bring in a lot of political capital. Arctic issues have been upgraded in the US policy system and Secretary of State John Kerry has a passion for these issues.

On the global agenda, climate change is the big issue connected to the Arctic. The Twenty-First Conference of Parties of the United Nations Framework Convention on Climate Change (COP21) in Paris was the last real opportunity to halt catastrophic climate change. Curbing emissions and adapting to the impacts of climate change are the two big issues and these are reflected in the US program. Since the Arctic is not generating the emissions, it does not have a big role in mitigation. The US focus on renewable energy is very positive. The centrality of the climate issue is clearly articulated in the US program. Policymakers are generally confused about this issue as is the general public's understanding of the Arctic story.

Another key point, in Ólafsson's view, involves oceans' issues. Discussion of a regional seas agreement places this clearly on the agenda. There are other regional seas arrangements featuring conventions or less formal structures, so the Arctic States will have to closely examine these precedents. The emergence of an open Arctic Ocean requires a lot of thinking ahead. It will invite a lot of activity and we need to prepare in advance. Some contentious issues exist, but this will likely be a positive dialogue. The Arctic Council has a generative role, as discussed by Young, and this is the way the AC working group on the Protection of the Arctic Marine Environment (PAME) works. Building trust, identifying issues, creating networks, and generating ideas are key activities.

Sung Jin Kim provides a non-Arctic-state policy perspective on the U.S. Arctic Council Chairmanship. Kim observes that U.S. Arctic policy is positive and appropriate. It is also timely and promising. On thematic areas, improving living conditions in communities will require good technologies; the main issue here is financing large initial investments. Turning to ocean stewardship, Kim notes that change is inevitable. There will be increased demands for resources. The international community will need to make a common systematic effort. Marine protected areas (MPAs) should be considered in a connected and systematic network. Looking to climate change, Kim asserts that most pollution comes from outside of the Arctic, so development of a response effort extending beyond the Arctic is needed. Inside the region there needs to be action against naturally occurring events such as fire, permafrost melting, and so forth.

Korea is interested in cooperation and is formulating a master plan for its Arctic policy including exchange of Arctic information, technological cooperation, and bilateral cooperation from ship platforms used for research. According to Sung Jin Kim, Korea is also interested in cooperation with the Arctic Economic Council (AEC). Korea has a strong interest in the Northern Sea Route north of Russia. Korea supports the International Maritime Organization (IMO) Polar Code for responsible shipping and would like to see international research on northern shipping routes carried out by PAME and the AEC.

Ye also provides a non-Arctic-state policy perspective on the U.S. Arctic Council Chairmanship. Ye discusses the role that China can play during the U.S. Chairmanship. China sees a close linkage between the Arctic and global affairs. This is not just because of the proximity of China to the Arctic region. Arctic issues are impacting China already. This is the rationale for China's interest in Arctic affairs. China and the United States cooperate on many other global matters. China recognizes the rights of Arctic states. It has no strategy for pursuing direct interests in the Arctic. The priorities are scientific research, transregional issues, and involvement with the AC as the most influential regional intergovernmental forum. China has a responsibility to be involved in Arctic issues because of their linkages to global governance.

According to Ye, climate change is the main priority for China to work with the United States. China wants to reduce its dependence on fossil fuels by 2030. China can cooperate by targeting short-lived climate pollutants, supporting adaptation and resilience efforts, creating a pan-Arctic digital elevation map, and continuing to strengthen its policy dialogue and practical cooperation (including on coal technologies). Most of China's scientific work in the Arctic has involved climate change. So the AC is a good forum for cooperation. China has conducted six science expeditions on sea, snow, ice, atmospheric processes, biology, and geology in the Arctic.

Ye advocates treating the Arctic as an area for cooperation in relation to economic and living conditions and ocean stewardship. But these issues are a lower priority for China than climate change. China might be able to contribute on renewable energy technologies, microgrid systems, and public-private partnerships on affordable energy. China has no interest, other than secure shipping and search and rescue capacity, in security issues in the Arctic.

Commenting on chapter 2 from Arctic-state scientific perspective, Young provides a view from the research community on the U.S. Arctic Council Chairmanship. Young begins by distinguishing between substantive themes and organizational goals. According to Young, there are three important goals in the U.S. Chairmanship program: (1) strengthening the AC, (2) introducing long-term priorities, and (3) increasing awareness of climate change. The AC's role is largely generative rather than regulatory.

There is no need to turn the AC into a normal intergovernmental organization. Areas in need of attention include: (1) the mismatch between the sustainable development and environmental protection programs, (2) the lack of a clear division of labor between the working groups and the task forces, and (3) ambiguities regarding the organization and remit of the AEC. Task forces were not highlighted in the creation of the Arctic Council in 1996 but now a clear division of labor needs to be explored vis-à-vis the working groups. Young raises the question: How can the relationship between the two become a source of synergy rather than of friction? The AEC is still subject to misunderstanding that needs to be sorted out.

The Arctic Council's long-term priorities are clear: (1) promote sustainable development in Arctic in the face of rapid biophysical and socioeconomic change, (2) play an integrative role with regard to activities of the multiplicity of bodies addressing needs for governance in the Arctic, and (3) maintain cooperation between the Western members of the AC and Russia. To raise climate change awareness, the United States might consider documenting observable impacts of climate change in the Arctic; highlighting dramatic evidence of sea ice loss, coastal erosion, melting permafrost, and so forth; taking steps to address issues of adaptation in arctic communities; and identifying best practices in Arctic governance.

In commenting on chapter 2 from a Japanese scientific perspective, Okamatsu discusses Japanese responses to the U.S. Arctic Council Chairmanship. If ice loss results in new sea routes, Japan will be a stakeholder, though not an Arctic coastal state. Japan is carefully monitoring the global environmental changes resulting from Arctic developments. Japan has a long history of Arctic research and can make contributions in this area:

- Ministry of Education, Culture, Sports, Science and Technology (MEXT): technology and satellite observations for adaptation and mitigation;
- National Institute of Polar Research (NIPR): observational science in the Arctic;
- Japan Agency for Marine-Earth Science and Technology (JAMSTEC): sea ice reduction and its relationship to climate change impacts on Japan; and
- Japan Aerospace Exploration Agency (JAXA): monitoring greenhouse gases from space for the Arctic and globally.

Okamatsu explains that Japan is interested in research relating to navigation. Japan participated in the 1993–99 International Northern Sea Route Programme studying fuel requirements and shipping times. Japan is keen to share its scientific knowledge and research technologies to promote sustainable development and environmental protection in the Arctic.

PART II: CLIMATE CHANGE—POLICY IMPLICATIONS FOR THE NATIONS WITH ARCTIC INTERESTS

In chapter 3, "Climate Change: Mitigating Arctic Impacts and Adapting to Changed Conditions," Armstrong raises five key points regarding the impacts of climate change in the Arctic:

- *Sea level rise and related coastal inundation*—There is an accelerating rise in global sea levels with about one-third attributable to the melting of the Greenland ice sheet and other high-latitude glaciers.
- *Opening of the Arctic seaway*—The thinning of the Arctic sea ice and dramatic reductions in its areal extent every summer are opening opportunities and challenges for new shipping and trade routes, natural resource (fisheries, oil, gas, and mineral) development, and tourism and changes affecting the residents of the coastal communities along the route (particularly indigenous peoples).
- *Weather extremes*—
  (a) *More frequent extremes:* Recent observations show more frequent extremes across the globe; what were previously observed as "one in a hundred" year events now appear to be "one in twenty" year events or even more frequent,
  (b) *Heat extremes:* Heat extremes in lower latitudes have a significant effect on agricultural regions. The impact of temperature extremes on crop production has been well documented. With the likelihood of more hot days with record heat and precipitation changes, crop yields are more vulnerable,
  (c) *Stronger hydrological cycle:* A stronger hydrological cycle, influenced by the polar vortex and changes in the jet stream, appears to be leading to more water per storm across the globe. A warmer atmosphere means more water vapor in the atmosphere which leads to individual storms releasing more water per storm.

Some regions of the northern hemisphere have seen a 30 percent increase in such intense rainstorms, and

(d) *Simultaneous extreme events:* Simultaneous extreme events are likely to increase. Events such as Hurricane Sandy will cause unprecedented consequences for northern hemisphere regions.

- *Ocean acidification*—The increases in ocean acidification documented in higher levels of the Arctic Ocean are projected to have economic impacts on marine ecosystems, Arctic fisheries, and the recreational value of Arctic ecosystems as well as consequences for marine management.
- *Permafrost thawing and resultant climate feedbacks*—The major attention has been on the fact that permafrost stores an immense amount of carbon and methane (twice as much carbon as contained in the atmosphere). In a warming environment, permafrost is expected to degrade, and these gases may be released in the decades ahead. Although studies have suggested that the release has not accelerated substantially in recent years, research in some regions suggests that this process has already begun in Western Siberia.

Turning to the theme of "Governance Issues: Taking Knowledge to Strategic Decisions," Armstrong presents four different yet interrelated policy options for bringing science and information into policy and the overall decision-making process:

- *Mitigation*—actions taken to promote the reduction of greenhouse gases (GHGs, including CO_2 and methane as well as a host of other gases of less significance) in the atmosphere;
- *Adaptation*—actions taken to promote a change of state of an entity from a vulnerable or unstable condition to a less vulnerable, more resilient, and more stable condition;
- *Climate engineering*—while less widely discussed, this includes any actions taken to withdraw GHGs from the atmosphere; and
- *Suffering*—also less widely discussed, this is noted in passing as doing nothing; this means taking no steps toward providing mitigation, adaptation, or climate engineering actions.

In commenting on Armstrong's chapter from a scientific perspective, Corell argues that there is an increasing probability that humankind is entering a new era of unstoppable sea level rise. Averaged over all land and ocean surfaces, temperatures have warmed about 0.85° Celsius (1.53° Fahrenheit) from 1880 to 2012. The Earth's systems are very sensitive to such temperature changes, which cause seawater to expand and ice sheets and glaciers worldwide to melt, gradually raising global sea level. Over the past year or so, research has documented that there is new evidence suggesting that the collapse could happen faster, largely based on the observation that warmer ocean waters are pushing up from below and bathing the base of polar ice sheets.

Further, according to Corell, over the past several decades the accelerated warming of the Arctic has dramatically reduced the volume of sea ice; the age of 85 percent of the sea ice is now between one and two years. Thinner and softer ice substantially reduces the need for high-powered icebreakers. There is increasing scientific evidence that links rapid warming of the Arctic to mid-latitude weather patterns. Corell remarks that changes in circulation are expected to continue to lead to extreme weather events in the Northern Hemisphere.

Corell agrees with Armstrong that the Arctic oceanic waters are more likely to be affected by acidification because CO_2 dissolves more quickly in colder water. Like Armstrong, Corell emphasizes the fact that there are trillions of tons of carbon locked in the frozen Arctic soils known as permafrost. These stores of carbon had not, in upwards of millions of years, interacted with the atmosphere or hydrosphere, affecting the rates and magnitude of the warming of the planet.

On the governance issues raised by Armstrong, Corell adds two additional references: "*Climate Adaptation: Seizing the Challenge,*" prepared by World Economic Forum, and "*Informing Decisions in a Changing Climate,*" released by the U.S. National Academy of Sciences. Corell adds a series of focal points in response to the narrower question: *What is happening within the Arctic that is important within the Arctic?* Specifically, Corell suggests: (1) address more directly the consequences of change, (2) identify opportunities to enhance human and societal well-being, (3) increase the resilience of socioeconomic and ecological systems, (4) identify and implement strategies for stewardship, (5) address the human dimensions of change, (6) identify the potential of adaptive actions, (7) introduce the construct of "*The Climate, Energy, Economic Conundrum,*" and (8) identify more explicitly the role of science in policy processes for the nations with Arctic interests.

Corell concludes his commentary by proposing further works: encourage use-inspired research and improve and extend modalities and enhanced methods in order to strengthen policy decisions (such as the concepts and the "Principles for Taking Information to Action" posited by the author of chapter 3), particularly the "Science-Decision Cycle" strategy.

In his commentary on chapter 3 from the science and diplomacy perspective, Arnaudo emphasizes the importance of science in Arctic cooperation. According to Arnaudo, under its goal relating to climate change, the United States has selected two specific areas as focal points for the next two years: black carbon and adaptation problems for Arctic communities. Black carbon emissions are notably problematic in ice-covered areas because these pollutants turn white reflective surfaces into dark absorbent ones, a serious problem for the white North. A focus on adaptation problems for communities will emphasize the human dimensions of this global threat, including the displacement of coastal communities, the impacts of permafrost melting, and changes in animal migration patterns, to name just a few.

Under its other goals, the United States will also address the issues of marine protected areas (MPAs), renewable energy, and water and sanitation, all of which are impacted by climate change. Arnaudo argues that any discussion of the role of science in negotiations and global cooperation must address the problem of communication among the science community, the negotiators, and the broader public. Arnaudo hopes that Arctic nations will continue to advance scientific understanding that will provide the basis for assessing future impacts of climate change and proposed response strategies.

In commenting on chapter 3 from the Intergovernmental Panel on Climate Change (IPCC) WG 2 perspective, Larsen asserts that the impacts of climate change in the Arctic must be seen in the context of interconnected factors. Climate change exacerbates the existing stresses faced by Arctic communities. Impacts on health and well-being of Arctic residents are significant and are projected to increase, especially for many indigenous peoples.

Turning to the economic impacts of climate change, Larsen emphasizes that while optimism surrounding resource extraction remains, there is reason to temper current expectations. Challenges remain in measuring the economic size, real benefits at different scales, and economic potential of resource extraction. On adaptation, Larsen argues that the rapid rate at which climate is changing in the polar regions will impact natural and social systems and may exceed the rate at which some of their components can adapt effectively. Looking to ways forward, with particular regard to the science/policy interface, Larsen stresses that assessments and science-based policy measures will become increasingly important. Human and fiscal capacity challenges exist that need to be addressed. Limitations of top-down approaches and down-scaling continue to create challenges. More and better science does not automatically lead to better decisions. Arctic success stories are important to consider in formulating strategies for adaptation. Larsen identifies important gaps in our current knowledge including monitoring, socioeconomic models, gendered dimensions, impacts on cities and urban areas, and institutional arrangements.

In commenting on Armstrong's chapter from a Russian perspective, Klepikov begins by describing how climate change is affecting the Russian Arctic. Temperature increases for the central Arctic are projected to be about 3–4°C over the next fifty years. According to Klepikov, the heat wave in Russia during the summer of 2010 caused overall losses of more than two hundred fifty billion rubles in the Russian economy. Changes in permafrost, which occurs in more than 60 percent of the territory of Russia, have already had a noticeable impact on the state of ecosystems, reducing the ground-bearing capacity of the soil.

Klepikov argues that, if no measures are undertaken, climate change may create a threat to the existence of the peoples of the North, especially in combination with socioeconomic tensions. The indigenous peoples should play a key role in the development of strategies to mitigate the adverse impacts.

Turning to Russia's adaptive responses to the consequences of climate changes, Klepikov remarks that both *ACIA* and the *Snow, Water, Ice, and Permafrost in the Arctic (SWIPA)* report provide a basis for detailed proposals to the federal and regional authorities of northern territories of Russia regarding adaptation strategies to deal with climate change and threats to biodiversity.

He then notes that the recent publication of the *Second Roshydromet Assessment Report on Climate Change and its Consequences in the Russian Federation*. The report includes a consideration of the impacts of climate change on shipping, offshore business activities, and marine biological resources in the Russian part of the Arctic Ocean. The most impressive response to global warming at the regional scale is a decrease in the extent and volume of sea ice in the Arctic. Klepikov observes that future ice conditions along the Northern Sea Route are important for designing new cargo and icebreaking ships, choosing new navigable passages, and maintaining Russian control over shipping in its economic zone.

Finally, Klepikov discusses the creation and expansion of public-private partnerships on environmental rehabilitation of hot spots in the Russian Arctic as a key feature of the Arctic Agenda 2020. According to Klepikov, the Arctic Agenda 2020 aims to facilitate proactive engagement of the largest Russian industrial and energy companies—such as Gazprom, Rosneft, Lukoil, and Norilsk Nikel—with Russian financial institutions in protecting the Arctic environment.

From Korea's perspective, Sung Jin Kim proposes that carbon capture and storage (CCS) and ocean fertilization could be useful geoengineering responses to climate change; more research and institutional support should be provided for exploring these options. Kim also proposes international and regional cooperation for exchanging Arctic information and knowledge among scientists, research institutions, states, and international organizations. In this regard, in 2015 the Korea Maritime Institute hosted the First International Seminar on Arctic Information and Knowledge. Such meetings should be continued so that knowledge and information-sharing networks can be created and the actual exchange of information happens. As a next step, coordination and cooperation of policies and projects could be promoted.

PART III: IMPLEMENTATION OF THE POLAR CODE

In part III, six experts discuss concrete issues relating to the Polar Code and articulate a variety of perspectives regarding issues of implementation and compliance. The Polar Code has been approved by IMO and is expected to enter into force legally in January 2017. The panel considers the identity of the major players and how they will interact with one another to make the Polar Code effective.

From the scientific perspective, Brigham reviews the history of the development of the mandatory Polar Code from 1993 to 2015. When it comes into force, the code will have been under development for almost twenty-five years. A draft code went to the IMO in 1998. But, until the latest round, there had been only a set of voluntary guidelines. Although the voluntary guidelines focused on the Arctic, the new mandatory code will cover all polar waters. Brigham outlines the main elements of the Polar Code and points out that it will not take the form of a new convention but rather a series of amendments and additions to the International Convention for the Safety of Life at Sea (SOLAS) and the International Convention for the Prevention of Pollution from Ships (MARPOL). The code applies to commercial carriers and passenger ships of 500 tons or more. There are many classes of ships and the idea was align regulations with the various classes of ships. A big issue is who will handle the training of the ship's masters. There was no agreement to require ice masters. Polar Ship Certificates are issued by flag states and this is a device to determine whether a ship is allowed to operate in polar waters. A ship's class determines the type of insurance that is required. Each ship must carry a *Polar Water Operations Manual* that is ship specific. The code delimits the maximum extent of Arctic waters where the regulations apply. Areas such as the Kola Peninsula and northern Norway are outside the area of application.

As the new Polar Code is not as comprehensive as many would like, Brigham identifies eight key Polar Code challenges:

- *Tight implementation timeline*—As final approval of all elements of the Polar Code came only in May 2015 and the code is due to enter into force on 1 January 2017, maritime states have a significant challenge to implement the Polar Code in their national legal and (maritime) administrative systems in a relatively short period.
- *Key roles of marine insurers and ship classifications societies*—The new Polar Code provides both industries with a set of uniform (non-discriminatory) international rules and regulations.
- *Commercial passenger vessel requirements*—The cruise ship industry will have significant challenges to meet the higher standards of marine safety equipment, personnel training, and mariner competency. Future ships might be okay but investments to upgrade existing ships are unlikely.
- *Experienced polar mariners*—It will take some time for the flag states to recruit and train a new cadre of mariners capable of operating safely in polar waters. There are several existing ice-navigation training centers in Sweden, Russia, United States, Canada, and Norway. But several flag states will elect to develop their own training

facilities in the decades ahead.

- *Roles of the Arctic states*—In the recommendations of the Arctic Council's *Arctic Marine Shipping Assessment (AMSA)* released in April 2009, the Arctic states affirmed their consensus that a mandatory IMO Polar Code was required as soon as feasible. The Arctic states share the challenges and responsibilities of providing visible proactive leadership during the code's implementation phase. It should be remarked that there is still a role for the Arctic Council to play in promoting implementation.
- *Role of the Arctic states as European Union members*—Denmark, Finland, and Sweden must articulate the urgency and importance of implementing the Polar Code as soon as possible to meet the tight deadline of 1 January 2017.
- *Enforcement of the Polar Code*—This will be an ongoing issue requiring cooperation and the use of the new Polar Ship Certificate.
- *Monitoring and tracking*—The Task Force on Arctic Marine Cooperation of the Arctic Council could talk about exchange of information, data assessments, and compliance issues.

Brigham then identifies future tasks: uniformity of application by coastal states, application beyond commercial carriers and passenger ships, addressing black carbon and emission controls, and integration with marine protected areas, particularly sensitive sea areas, and other protected areas.

From IMO's perspective, Yamada explains that the Polar Code is a Goal Based Standard (GBS) system. The Polar Code creates additional requirements to the SOLAS and MARPOL conventions and has to be read together with them. Yamada reviews the structure of the code. According to Yamada, part 1A covers many aspects of ship safety under SOLAS. The required *Polar Waters Operations Manual* is related to a ship's operational capabilities and is a new element of the code. Part 1A applies to ships, both passenger and cargo, on international voyages. It applies to existing ships and there is a short grace period to allow upgrading for compliance. Part IA was developed based on particular hazards of ice, temperature, high latitudes, and so forth. On the other hand, part 2A adds requirements to MARPOL annexes I, II, IV, and V. The code makes annexes I and II applicable to Arctic waters. Discharges of sewage in polar waters are prohibited except as permitted by the annexes in MARPOL.

Implementation is not a big concern even though it is a new mandatory code because the Polar Code is an extension of well established existing conventions. All requirements of SOLAS and MARPOL have already been implemented.

The third panelist, Grant, presents legal considerations from a Canadian domestic-law perspective. According to Grant's interpretation, the initial version of the Polar Code will be incorporated into the SOLAS and MARPOL conventions using the tacit-acceptance procedure in each convention. Tacit acceptance allows a convention to be amended without a formal amending protocol. The procedure creates a reverse onus. Amendments will come into force on a particular date unless they are objected to by a specified number of parties. Incorporation by reference will allow the Polar Code to remain as a stand-alone document. But each convention will only provide the force of law to those provisions of the code that fall under its respective scope of application. Mandatory safety requirements will be contained in a new chapter XIV of SOLAS. Mandatory pollution prevention requirements will be embedded in the relevant annexes of MARPOL. Entry into force under both conventions is coordinated for 1 Jan 2017.

Regarding effective enforcement, Grant thinks that tight time lines for implementing the code may pose challenges for some shipowners and administrations. States that must make statutory or regulatory amendments to implement the code will need to update domestic laws. In the case of all but certain cargo ships, issuance of the Polar Ship Certificate will require a survey. In addition, shipowners and operators will be required to develop a *Polar Waters Operations Manual (PWOM)* for each ship. Ambiguity will be created by Goal-Based Standards. Arctic states might wish to consider a region-specific port-state control agreement that would allow for more coordinated oversight.

Turning to uniform application, Grant considers that the Polar Code improves baseline safety and environmental standards for ships operating in polar regions. Use of the tacit-acceptance mechanism increases chances of quick and wide adoption of the code's requirements. A savings clause and article 234 of the United Nations Convention on the Law of the Sea (UNCLOS) could prompt some states to implement standards that are different than those set out in the Polar Code.

Park presents the perspective of ship classification societies (SCSs). According to Park, before the Polar Code, ice-class vessels were governed by SCSs. There are many such societies in the world; many countries have their own. Under the Polar Code, the SCSs are required to make universally applicable rules. This should be done by January 2017. Based on design and navigation of ships, mandatory requirements involve marine safety and pollution prevention. Park raises three key issues in preparing for the Polar Code: (1) the issuance of Polar Ship Certificates, (2) the compilation of *Polar Waters Operations Manuals*, and (3) the recruitment of qualified crews for ice-class vessels. On the last point, there are no qualified training centers, so this is a factor. Park then presents six issues relating to technical preparations in polar waters or cold climates:

- existing ships need to be prepared to operate in the Northern Sea Route (NSR);
- ship classification societies need to analyze the risks of vessel operations in polar waters;
- winterization for ice-class vessels needs to be addressed;
- ship classification societies need to set up databases for different regions of polar waters to ensure safe navigation;
- ship's crews who board ice-class vessels should be provided with appropriate training necessary for ice navigation; and
- measures are needed to prevent pollution caused by ships in the ice.

Once SCSs have set up these rules, they will go to IMO for approval. Park concludes that non-Arctic countries will have an opportunity to develop relevant technologies and needed regulations. On research and development, SCSs need to come up with *PWOMs* and personnel training and invest in research and development technologies. SCSs also need to cooperate with relevant organizations for sustainable development in the Arctic.

From a Russian policy perspective, Zagorski stresses that Russia's policy towards the Polar Code is based on two main considerations. First, there is a desire to continuously assert Russian jurisdiction over the NSR, mainly from considerations of security. From the governance perspective, it is not expected that the introduction of the Polar Code will interfere with existing Russian regulations applicable to vessel traffic in the NSR.

Second, there is a desire not to allow international regulations to restrict Russian maritime operations in the NSR area through establishing rigid environmental restrictions. This approach is based on the assumption that, contrary to general belief, significant foreign vessel traffic along the NSR other than by Russian vessels operating in the North is not expected to occur any time soon. Russian domestic regulation of vessel traffic in the NSR is largely centered on safety issues. Since the Polar Code's *safety provisions* are considered to be largely consistent with requirements of Russian regulations, the introduction of the code is widely supported by the shipping industry, and particularly by large shipping companies (e.g., Sovkomflot) that believe they can afford to comply with the established standards.

However, many pollution protection measures included in either mandatory or voluntary parts of the code are a major subject of criticism in Russia. Many Russian vessels, particularly diesel-powered icebreakers and auxiliary vessels using heavy fuel oil, would hardly be able to meet the requirements, and many of them would have to be either modernized or simply replaced. For this reason, in the process of elaboration of the Polar Code, Moscow sought to exempt its vessels engaged in destinational shipping in the NSR area, and particularly those operating in ice-covered waters for a longer period of time, from most of the suggested pollution prevention measures. The final compromise allowing category A ships constructed before 1 January 2017 and "operating continuously in Arctic waters for more than thirty days" to comply with the ban on discharge into the sea of oil or oily mixtures one year after the entry into force of the Polar Code is seen as a suboptimal solution, perhaps even harmful to Russia's interests.

From Japan's perspective, Okamatsu comments that Japan has a keen interest in the potential use of the North Sea Route but recognizes environmental issues. The Polar Code will create stricter regulations. According to Okamatsu, Japan has advanced ship building technology. The Polar Code will affect Japan's policies and practical ship building technologies. The possibility of accidents has the most impact on coastal states. From a legal view, the issue will be the legal status of the Arctic region. Flag states have high seas rights. National laws sometimes try to impose stricter regulations outside their territorial seas. Okamatsu raises some issues of interpretation regarding article 234 of UNLCOS and issues of jurisdiction, geographical locations, and situational circumstances. If the sea ice melts, then article 234 might not apply. She also considers interpretations of article 211(5) and (6) and articles 34, 35, and 36 regarding straits used for international navigation. The issue is when and where domestic laws might continue or not continue to apply. If Japanese ships ply these waters in the future, issues concerning the priorities and jurisdictions of domestic and international laws may emerge.

PART IV: THE IMPACTS OF SHIFTING WORLD ENERGY MARKETS ON ARCTIC RESOURCE DEVELOPMENT

In chapter 4, "The Impacts of Shifting World Energy Markets on Arctic Resource Development," Pumphrey begins by addressing increases in the supply of oil and gas. He argues that technologies have been developed and deployed that will allow commercial production of shale gas and tight oil at prices that may be lower than the price required to make Arctic development profitable. From 2005 to 2014, shale gas grew from virtually zero to about 40 percent of total gas production. Driven by tight oil production, US crude oil production increased by nearly 60 percent between 2010 and 2014. Shale gas and tight oil in the United States is being developed in relatively shallow (1,500—2,100 m, 5,000–7,000 feet) onshore zones where wells can be drilled and brought on stream in a matter of weeks rather than months or years. Deep offshore wells and wells in the Arctic will take years to bring into production at a cost of multiples of individual shale gas and tight oil wells. Shale gas and tight oil wells also have relatively steep production-decline curves. Sustaining production requires continual drilling of new wells in contrast to the experience with fields with large reservoirs that will sustain peak production longer and decline more slowly.

Altogether, this means that unconventional oil and gas production can respond rapidly in response to market developments. The United States is expected to become a net exporter of gas by 2017. The approved export projects are equivalent to approximately 112 million tons of liquid natural gas (LNG). The total world consumption of LNG in 2015 is estimated at about 270 million tons. The actual level of exports from the United States will be determined by global demand and other sources of supplies, but the United States is establishing its potential to become a major player in global markets.

Pumphrey notes that the largest amount of shale oil is estimated to exist in Russia with the United States second. The largest shale gas resources are believed to exist in China with Argentina second. Actual development and production of these resources will depend on many factors including geology, oil prices, government policies, environmental restrictions, and public reactions. A number of factors allowed the United States to lead in the application of this technology, including a well-developed industry with many small and medium-sized companies that was able to move quickly to begin drilling, private ownership of mineral rights that allowed quick signing of leases, an extensive service industry that provided drilling and fracturing services, and a mature transportation network to move oil and gas to markets.

Turning to reductions in demand, Pumphrey argues that improvements in the overall efficiency of vehicles and the use of alternative fuels and transportation methods have significantly lowered expectations regarding future levels of oil consumption. The International Energy Agency (IEA) believes that the recent trends in consumption will continue with declining oil consumption in the Organization for Economic Co-operation and Development (OECD) countries coupled with increases in developing countries. The latest IEA forecast projects increases in global oil consumption by about 14 million barrels/day, a growth rate of about 0.5 percent/year, which is the lowest growth rate of any fuel. The implementation of policies to reduce carbon emissions could apply additional pressure on the demand for oil and natural gas.

Pumphrey indicates that the shifting balance between supply and demand for oil and gas has led to lower prices. Regarding the implications for Arctic petroleum development, the key question is whether this will lead to a long-term price path that could cause projects to be deferred or cancelled, leaving high-cost projects stranded. Analysts believe that the price range that will impact shale production is from USD 65–75/barrel. Some large Arctic oil discoveries, especially in ice-free or limited ice regions, may go forward even at these lower prices. Gas projects are likely to be extremely difficult given the higher production and transportation costs of gas. Potential supplies are sufficient to meet global demand. The well-known United States Geological Survey (USGS) appraisal estimated that the mean value for recoverable oil resources in the Arctic is nearly 90 billion barrels of oil and 1,669 trillion cubic feet of natural gas. For comparison, the global estimate of technically recoverable shale oil is 345 billion barrels and 7,299 trillion cubic feet of gas. Russia is expected to control about 60 percent of the total Arctic conventional resources, 34 percent of the oil and 69 percent of the natural gas.

While technological challenges for the industry remain, the principal consequences of dealing with Arctic conditions, especially in ice-infested areas, are that exploration, field delineation, and installation of production facilities will take significantly longer than field development in non-Arctic areas. The longer time necessary to reach commercial production has the greatest impact on the economic returns from a project. A long delay in earning income from such a large investment significantly reduces the net present value of these projects. Since the drop in oil prices starting in 2014, several companies have announced a reduction in investment plans in the Arctic. But Shell is continuing efforts to start exploratory drilling in the Chukchi Sea off Alaska and has been given preliminary approval by the U.S. federal government to start drilling.[2] Shell has invested USD 7 billion since acquiring leases in 2008 and hopes to drill its first exploratory well in the Chukchi Sea this summer. A key issue for Arctic oil and gas development is the ability to ship oil and gas to southern markets in a cost-effective manner. For oil, the cost of shipping is relatively low, especially when tankers can be utilized, and should not significantly constrain development of new fields even in difficult areas. For natural gas, transportation costs are much higher relative to the value of the gas. In a market where the gas may be sold at USD 10–15/million British Thermal Units (mmbtu), LNG liquefaction and shipping costs of USD 4-8/million mmbtu (and perhaps higher for Arctic projects) will be a critical determinant of the economic viability of a project. Arctic oil and gas exploration and development have met broad opposition from environmental groups and indigenous communities. Whether these efforts will stop drilling activities is uncertain, but adding additional time to exploratory drilling will affect the economics of project development. Continued environmental resistance can also create a reputational risk for a company.

Commenting on Pumphrey's chapter from the perspective of energy policy, Moe argues that the profitability of Arctic petroleum projects is determined by the prices at the time when a project starts producing, which may be at least fifteen years from the start of the project as well as over the whole lifetime of a project, which may be twenty-five to forty years. Nevertheless, the current decline in oil prices has had an immediate impact on Arctic exploration. This is because the financial situation of oil companies has deteriorated, affecting the availability of funds for investments in exploration. The general conclusion is clear: Arctic development is slowing down. Still, individual countries may have specific reasons to encourage production despite a generally complicated market situation. The economies of Norway and Russia are both highly dependent on petroleum revenues. Norway has continued to announce licensing in the Barents Sea. Fifty-four blocks were offered in January 2015, thirty-four of them located in the previously disputed area with Russia. It is too early to say whether the new situation in the oil market will limit interest in this area. But it should be recalled that the Norwegian tax rules allow companies to deduct exploration costs from income generated elsewhere in Norway. This means that the state effectively covers 80 percent of the costs, a major incentive for exploration. Norway has a particular interest in exploring areas adjacent to the boundary line with Russia, since transboundary fields are likely to be discovered at some point. It will be important to have a comprehensive understanding of the geology to be able to develop unification schemes, as prescribed in the 2010 boundary treaty.

The Snow White (Snøvit) gas field has been producing since 2007. Plans for extending the LNG plant in Hammerfest with a train were advanced when the license group headed by Statoil decided to cancel this project in 2012. The Goliat oil field will start producing in 2015. Investment costs are estimated to be USD 5.6 billion. Some analysts argue that the project needs an oil price of USD 95/barrel to break even and that on average a price of USD 60/barrel is required in the Barents Sea.

A convincing long-term commitment to supply the European gas market is essential for Norway to retain its strong market position. Production in the North Sea and Norwegian Sea will level out and start to fall, but big new gas discoveries are expected in the Barents Sea. According to this reasoning, Norway should extend its pipeline system northwards to the Barents Sea to allow gas from that region to reach the market. It seems likely that the government will come up with schemes that make it possible to attract investors in a pipeline and also make it attractive to develop relatively high-cost Arctic gas to be mixed with low-cost North Sea gas, thus maintaining the desired export volumes.

Russia has a huge onshore resource base, but it is underdeveloped and new fields are much smaller, more geologically complicated, and more remote than earlier fields when both the oil and the gas industry could rely on giant fields in West Siberia. The Arctic—and especially the offshore area—has been touted as Russia's resource base in the twenty-first century. Geological indications of huge resources in big concentrations would seem to offer an attractive solution to Russia's search for new production capacity. It also fits the industry structure, with big companies focused on big projects. Recent Russian offshore licensing practices involve huge areas, rather than selected blocks as is the custom elsewhere, leaving resource management to the license holder. Rosneft has set out to explore these license areas with the help of foreign companies. But the resultant deals also have made it clear that Russia is heavily dependent on experienced Western companies for development of its offshore resources. As a result, the sanctions imposed following the crisis in Ukraine in 2014 seriously complicate the outlook for Russia's Arctic offshore projects. The official Russian (and Rosneft) position is that Western companies can be replaced by other, primarily Asian, companies and domestic technology. But this seems unrealistic, since Asian and domestic companies do not possess the necessary experience and competence to operate in remote offshore areas.

In some smaller shallow-water projects in the Pechora Sea, Asian companies are assuming a larger role. In 2015, the government is considering serious proposals to lift the offshore monopoly held by Rosneft and Gazprom. But 80 percent of the fields on the continental shelf have already been licensed to Rosneft and Gazprom. The major Arctic petroleum development now taking place in Russia is the Yamal LNG project. There are strong political drivers behind the project. It fits well into the Russian government's ambition to develop its Arctic region and to establish a large, stable customer base for the nuclear icebreaking fleet. Studies indicate that the project would not have been economical, even before the fall in oil prices, for investors without substantial state subsidies including funding infrastructure (the port of Sabetta) and various tax concessions. Further Arctic energy development depends on the state of the Russian economy. Even if highly prioritized, the Russian government may not be able to continue to offer the level of subsidies and tax benefits necessary to get Arctic projects under way.

From the Russian geopolitical perspective, Zagorski comments that while global investment in energy development is shifting increasingly from continental-shelf projects to unconventional and renewable sources, Russian corporations are most likely to continue investing in the development of conventional gas and oil and to do so increasingly in the Arctic.

The dominant public perception in Russia is that the potential of hydrocarbon resources (oil, natural gas, and condensate) of the Arctic continental shelf is so large that they can and will make a difference in global energy markets. Although Russian assessments of the size and global importance of Arctic resources are highly inflated and remain speculative, they fit perfectly into the broader policy discourse which rests on the thesis that, sooner or later, Russia is destined to move onto the Arctic shelf for oil and gas. This thesis is based on the projection of a decline, after 2020, in oil production from depleting old fields. As a result, Russian oil exports, currently averaging ~300 million tons/year, are expected to drop and stabilize at a sustainable level of ~180–200 million tons/year in the years to come. The Russian energy industry is extremely conservative and inflexible in its approaches. It feels the political will to invest in the development of Arctic resources and offers solutions that follow the path of experiences and projections accumulated during the last fifty years of developing oil in Western Siberia. Since the cost of hydrocarbon extraction in the marine Arctic is now ~1.5 times higher than onshore, the main effort is devoted to lowering these costs, especially by developing viable transportation solutions (a combination of marine transportation, rail links, and pipelines), since transportation costs are estimated to amount to 60–80 percent of the total cost of extracting Arctic resources, both onshore and offshore.

According to estimates of the Russian Research Institute of Oil Geology, with the oil price under USD 100/barrel and the current taxation regime, less than 1 percent of initially recoverable resources on the Arctic shelf can be classified as highly profitable. Onshore Arctic projects would be twice as profitable as those offshore. Russian experts identify unconventional oil as a viable alternative to developing the Arctic shelf, particularly since significant deposits are supposed to be located in the old oil provinces of Western Siberia, offering well-established infrastructure. Nevertheless, the Russian energy industry is generally highly skeptical, if not dismissive, with regard to shale gas or tight oil and tends to regard them as an annoying but short-lived phenomenon on the market.

Despite the apparent "Arctic pivot" and the readiness to absorb government investment, the Russian energy industry remains pragmatic. It is fully aware not only of opportunities but also of risks and limitations of moving further north and particularly offshore in the near future. This explains the current concentration on a number of onshore projects in the western part of the Russian Arctic that promise significant output. In parallel, exploration of promising shelf areas and relevant shallow-water deposits for eventual development continues.

The Yamal LNG project and the construction of the Sabetta port are seen as flagships of this development and enjoy high priority. Current

Western sanctions against Russia, reducing or prohibiting access to relevant investment and technologies, delay the movement of Russian companies onto the Arctic shelf. The growing cooperation with East Asian and, particularly, Chinese companies is unlikely to compensate for that loss of expertise. However, the most important bottom line for decisions by Russian companies to move onto the Arctic shelf is set by the oil price and the comparative costs of developing Arctic oil and gas on land. As long as the oil price remains low and there remains room for further expanding the development of resources in the terrestrial Arctic at a lower cost, critical decisions to expand the work on the shelf are unlikely, despite the inertia of the earlier enthusiasm for the development of the Arctic.

In commenting on chapter 5 from the perspective of the US energy industry, Slutz argues that US shale oil production is anticipated to decline by a million barrels per day relative to 2014 production levels. New resources must be developed continually to replace production from older wells.

The Arctic can be divided into five different sectors based on water depth and ice, with different technology required to support oil and gas development in each sector. Technological constraints do not limit US offshore Arctic development. Concerns remain regarding the industry's capability to prevent and to deal promptly with spills in Arctic waters, especially in the presence of ice. Addressing these concerns will be central to the acceptance of extended seasons for drilling operations. New technology has the potential to extend the drilling season but has not been incorporated fully into prevailing regulations.

Since an Arctic well requires approximately eighty days to drill, two drilling seasons may be needed. Extending drilling seasons will substantially reduce costs. Many Arctic peoples support resource development so long as it allows their communities to maintain traditional lifestyles while also realizing the benefits of the twenty-first century. One key to harmonizing development with the needs of indigenous communities is to involve community leaders in the decisions for development.

From the perspective of China/Russia cooperation, Paik comments that a long-term cooperation agreement was signed in 2010 between the China National Petroleum Corporation (CNPC) and the Russian Sovcomflot Group regarding transportation of hydrocarbons as well as the servicing and support of offshore exploration and oil and gas production. Novatek, Russia's largest independent natural gas producer, is negotiating with

Chinese banks to obtain USD 10 billion in loans to finance the USD 27 billion Yamal LNG project in northwestern Russia, which could double Russia's share of the global LNG market. The fifteen years supply deal at 3 million tons/year (mt/y) volume will increase the use of the NSR. Beijing's financing of Novatek's LNG project will be critical; the key question is not whether financing will occur but the scale and timing of the financing. Due to CNPC's 20 percent equity stake in the project, Beijing looks unlikely to veto large-scale lending for Yamal LNG.

Sino-Russian cooperation is unlikely to offset Western sanctions. The real hope (in Asia) for Russian gas is China. Vladivostok LNG cannot work without Japan as a customer. Russia has focused increasingly on China as a market and industrial partner. The question is what this trend entails for Arctic development. It seems that China's State Council prioritizes the shipment of supplies of gas to China by pipeline for security reasons, as is reflected in the deal on supplies via the Power of Siberia (POS) pipeline.

This policy still leaves ample room for LNG imports, for which China has several alternatives. From China's perspective, the only realistic Russian LNG project is Yamal LNG, where CNPC holds 20 percent and has contracted for deliveries via the Northern Sea Route. China has been requested to come up with more financing (perhaps up to 60 percent) and it is possible that this will happen. China is negative to the western (Altai) gas pipeline (which could handle some of the gas surplus in West Siberia), as it has been denied access upstream. The corridor for this pipeline passes through a difficult area geologically as well as culturally for Altai people.

Russian talk of "Arctic survival" is only rhetoric. The real issue is to compensate for the decline of oil production from traditional sources. There is strong pressure from Rosneft for the government to continue funding Arctic offshore development.

Following agreement on its nuclear program, Iran may emerge as a new player in the gas market. The uncertainty is large and it would, in any case, take a long time. But Iran might not only compete with existing suppliers such as Norway and Russia but also help to stabilize the European market with more suppliers, making policymakers more willing to give gas a larger role in the longer term.

Even if most Russian climate scientists agree with the IPCC's conclusions, there is still considerable climate skepticism with alternative climate theories in Russia, and the issue of climate change is not a big factor in Russian energy policy.

In Norway, a lower oil price creates uncertainty about Arctic development. But, as in Russia, the government seems willing to take measures to support ongoing activity. Undoubtedly the challenge is larger in Russia and the question remains how much aid the state is able to provide to get projects underway. There are challenges to indigenous communities in some Arctic energy projects. These projects have economic and cultural as well as environmental components. One important measure is to identify particularly vulnerable areas.

PART V: ARCTIC STEWARDSHIP—PROTECTING THE ARCTIC OCEAN

In chapter 5, "Arctic Stewardship: Protecting the Arctic Ocean," Lalonde begins by noting three key topics: (1) combating pollution inside and into the Arctic Ocean from lower latitudes, (2) reducing the impacts of pollution using a variety of governance mechanisms, and, (3) eliminating pollution through longer-term strategies. Lalonde explains that regional approaches, such as those proposed by the Arctic Council through its working groups, are being tried today. However, a much more viable approach to governance will involve the participation of the wider world. There are a variety of governance models, many of which have been available for decades, including informal "soft law" arrangements, Arctic environmental protection agreements, a comprehensive international treaty, an Arctic high seas treaty, or a framework treaty on the Arctic Ocean.

One of the most flexible management tools is the creation of MPAs, which requires determining priorities and making choices. Each of the eight Arctic states has established some form of MPAs in their waters. The Arctic states, under the auspices of the Arctic Council, have identified areas of environmental and cultural significance that can provide the basis for a pan-Arctic network of MPAs. One of the major challenges is that the Arctic coastal states have different governance regimes. The Oslo and Paris Conventions (OSPAR) regime in the North Atlantic provides a good model for a potentially effective network in the Arctic.

VanderZwaag suggests, in his commentary from the scientific perspective on Lalonde's paper, that there is a need to rethink the management of toxic chemicals as a group rather than addressing individual problems such as reducing mercury. There is important work to be done on the conservation of migratory bird populations in the Arctic with the addition of non-Arctic states as partners. A framework is required for a regional network of MPAs. Also, the governance of the central Arctic Ocean (CAO) must be sorted out with the recent fishing moratorium declaration as a "starting point." Future refuge areas (for example, the last ice regime) should be identified prior to any summer shipping in the CAO.

In commenting on Lalonde's chapter from PAME's perspective, Ólafsson notes that 40 percent of the globe is "unregulated"; 10 percent is the goal for MPAs in the global ocean. He also notes the growing global concern for climate change and ocean acidification. Ólafsson presents four focal points:

- The U.S. Arctic Council Chairmanship has identified Arctic Ocean Safety, Security and Stewardship as one of three key themes; a regional seas agreement will also be studied by the Arctic Council Task Force on Arctic Marine Cooperation. Hopefully, the Arctic Council can produce a blueprint for the Arctic states on MPAs using an activity-based instrument.
- In many respects marine pollution control is a success story in that the Arctic Council has focused some of the efforts of PAME and the Arctic Monitoring and Assessment Programme (AMAP) on this topic. PAME is engaged in defining a potential Arctic MPA network, but this work will require much deeper discussions.
- The OSPAR Convention provides a practical approach to MPAs that has achieved several successes. However, there are important differences between OSPAR and Arctic approaches; there are uncontested approaches to biodiversity issues.
- There are a number of significant challenges: climate change, acidification, participation of eight (or fewer) Arctic states, conservation vs. resource utilization, and the potential structure of governance regimes.

From the nongovernmental organization (NGO) perspective, Speer of the Natural Resources Defense Council comments that there is a great opportunity for the Arctic states (and the whole Arctic community) to "do it right" with regard to Arctic marine protection. There is a need for caution, but addressing the protection of Arctic marine ecosystems and the Arctic peoples who depend on these systems is a worthy challenge.

Marine protection in the Arctic Council's working groups [those on the Conservation of Arctic Flora and Fauna (CAFF) and PAME] has a good base of political support. The United States is providing support to the overall MPA effort and some action may be taken during the U.S. Arctic Council Chairmanship. Speer outlines five issues and challenges:

- We must identify key Arctic areas on a scientific basis and protect as many of these areas as possible.
- Analyses must use the concept of connectivity for key species.
- The concept of community vulnerability must be applied to coastal areas.
- We need to overcome the lack of mechanisms (other than the fisheries moratorium) applicable to areas beyond national jurisdictions.
- MPAs must involve more regional cooperation as individual MPAs are linked.

Discussion followed, first among the commentators and then among the entire group. OSPAR was highlighted as a potential management tool for efforts to manage the Arctic marine environment. A regional seas agreement might be more applicable and produce consensus among the eight Arctic states and the permanent participants of the Arctic Council. Ecosystem-based management (EBM) is only beginning to take shape in the Arctic. This holistic approach is important because it takes into account the full array of actors and interactions. A major challenge is to learn how to apply EBM to complex coastal areas and the Central Arctic Ocean. Several participants questioned whether the Arctic Council is the best body to deal with these issues. Others commented that the Arctic Council has been able to promote cooperation despite the influence of global geopolitics.

PART VI: HEALTHY COMMUNITIES IN THE ARCTIC: IDENTIFYING SUCCESS STORIES AND IMPROVING LIVING CONDITIONS

In chapter 6, "Identifying Success Stories and Improving Living Conditions in the Arctic," Egeesiak begins by noting the importance of art, culture, customs, and food practices to indigenous peoples. She offers a short history of the Inuit Circumpolar Council (ICC). The ICC, representing

Inuit in Greenland, Canada, Alaska, and Chukotka, promotes Inuit rights internationally. Eegeesiak remarks that the discussions during the previous session were more about economics than about the environment or the issues of concern to indigenous peoples. Many of these issues, from natural resources development to the challenges of a changing climate (including some of the negative challenges of low employment, food insecurity, and high suicide rates), have origins outside the Arctic. She suggests three words for success: (1) inclusiveness, (2) respect, and (3) responsiveness. Eegeesiak concludes by noting that the Arctic is not empty and that Inuit are pragmatic and adaptable people who welcome cooperation and collaboration. Inuit have limited financial resources but they will do all they can to continue to reach out to the rest of the world.

In his commentary from a scientific perspective on Eegeesiak's chapter, Coates begins by arguing that the Arctic pays the price for the delays in dealing with problems (e.g., climate change) attributable to interests and forces outside the region. He notes that the Arctic is the warning zone for the planet, experiencing damage from globalization attributable to southern actions. Coates urges positive initiatives to improve the health of communities in the North and to identify ways and means to improve the quality of life in the Arctic.

Offering an Alaskan perspective, Michels adds details regarding many points made by Eegeesiak. Michels then reports that western and northern Alaska's rural communities are facing multiple challenges from climate change and are working on adaptation strategies. Negative effects of climate change include the lack of access to marine mammals, causing food insecurity to become one of the top priorities for Alaska Natives. Many rural communities in Alaska have a high poverty rate and lack access to basic necessities such as running water, sewage systems, and adequate housing. Urgent actions are required to improve the health of Arctic communities and to identify ways and means to improve the quality of life in the Arctic. The high cost of transporting goods exacerbates the issue.

Michels then discusses how Alaskan communities have responded to climate change. Most communities include adaptation and mitigation measures in their local hazard mitigation plans (LHMPs). Furthermore, the state of Alaska has considered pilot projects for co-management of fish and wildlife.

From a Saami perspective, Turi begins by describing, with an emphasis on reindeer herding and fisheries, the Saami culture and people. Indigenous peoples have organized together for some time to address their common interests and advocate for their rights nationally and internationally. The Saami Council has a history, going back to 1956, of focused efforts to retain the culture of the Saami, much like Eegeesiak noted in her discussion of the ICC as an advocate for "Inuit rights internationally." The Saami are most concerned about land-use changes restricting access to areas they have traditionally used.

Almost 25 percent of these lands already have been lost to development by non-Saami. Coastal Saami fishermen are also loosing their rights to fish because of outside commercial fishery interests and activities. While the scientific community is making efforts, there is still much work to be done to overcome the lack of use of "traditional knowledge" to supplement Western scientific knowledge. These are distinct "ways of knowing" that, together, could yield a richer dialogue on common issues and challenges. The Saami Council is supportive of the admission of observers, including non-Arctic countries, to the Arctic Council and is confident that cooperation can be achieved.

Commenting on Eegeesiak's paper, Jong Deog Kim provides a non-Arctic-state perspective on healthy communities in the Arctic. He offers an overview of Korea's perceptions of the Arctic, stating that Korean interest has been expanding over the past decade. He emphasizes the importance to Korea of being an observer to the Arctic Council. He identifies key activities in preparing a Korean national policy for the Arctic, including appointing an ambassador for Arctic affairs (Chanwoo Kim, who participated in the conference) and establishing new institutions to support Korean interests in the Arctic. Kim advocates improving methods to integrate Korea's research efforts into the activities of the Arctic Council, noting that "many observer states have allocated significant funds for Arctic research but more discussion, through the Arctic Council or other international cooperative mechanisms, is needed regarding how best to utilize those research funds to actually address Arctic challenges. Systems should be devised to better reflect the research priorities of the indigenous groups."

THE NEXT STEPS

The 2015 North Pacific Arctic Conference (NPAC) began to probe the increasing complexity of Arctic issues and the consequences of policymaking for both Arctic states and non-Arctic states. In 2016, the North Pacific Arctic Conference will seek to explore these developments more deeply under the theme of "Arctic Futures: Emerging Issues, Policy Responses." Following up on the discussions reported in this introduction and overview, we will start with a mid-term report on the progress of the U.S. Chairmanship of the Arctic Council as seen from various national perspectives.

NPAC 2016 will examine climate change, focusing on the implications for the Arctic of the Twenty-First Conference of Parties of the United Nations Framework Convention on Climate Change (COP21). NPAC 2016 will also consider initiatives emerging from outside the framework of the Arctic Council dealing with Arctic issues and the prospects for Arctic petroleum development out to 2030 and 2040. An innovation for the 2016 conference will be a discussion engaging all the participants in the conference, led by an experienced facilitator, on Arctic futures. The goal is to influence the policymaking process by identifying emerging Arctic issues, framing them for consideration in policy arenas, and moving them forward in the queue of issues on policy agendas in both Arctic and non-Arctic states.

Notes

1. Many of the following points are based on session chairs' reports from the 2015 North Pacific Arctic Conference, prepared by Charles Morrison, Robert W. Corell, Oran R. Young, Yoon Hyung Kim, David VanderZwaag, and Bernard Funston.
2. Since the completion of this paper, Shell has withdrawn from active exploration in the Chukchi Sea.

PART I

THE ARCTIC AGENDA

2. The U.S. Arctic Council Chairmanship Workplan

Julia L. Gourley on behalf of the U.S. Department of State

The 2015–2017 Arctic Council workplan during the U.S. Chairmanship contains initiatives aimed at promoting Arctic Ocean safety, security and stewardship, improving economic and living conditions throughout the Arctic, and addressing the impacts of climate change.

Projects are undertaken through the Arctic Council's six working groups, three temporary task forces, and one expert group: the Arctic Contaminants Action Program (ACAP); Arctic Monitoring and Assessment Programme (AMAP); Conservation of Arctic Flora and Fauna (CAFF); Emergency Prevention, Preparedness and Response (EPPR); Protection of the Arctic Marine Environment (PAME); Sustainable Development Working Group (SDWG); Task Force on Arctic Marine Cooperation (TFAMC); Task Force on Telecommunications Infrastructure in the Arctic (TFTIA); the Scientific Cooperation Task Force (SCTF); and the Black Carbon and Methane Expert Group (BCMEG).

For additional details on the projects listed below, please contact the chair or executive secretariat of the relevant working group, task force or expert group. Contact information is listed at the bottom of this chapter.

Search and Rescue

The United States will lead a search and rescue exercise (SAREX) comprised of Arctic States, regional, tribal and industry stakeholders, and Arctic Council Observers. The U.S. Government will generate an after-action report, including recommendations for further steps, for delivery by the end of the U.S. Chairmanship. We will encourage the tradition of Arctic Council chair countries holding SAREXs in accordance with the 2011 Agreement on Cooperation on Aeronautical and Maritime Search and Rescue in the Arctic and sharing the results with EPPR and other relevant Arctic groups.

Marine Environmental Protection

The Arctic Council will build upon existing preparedness and response programs by placing greater emphasis on research and information sharing regarding: effects of spills and effectiveness of countermeasures; the identification and mobilization of the resources necessary to mitigate the effects of a pollution incident; and the development of international guidelines for preparedness and response in this logistically challenging region. We will strive for increased sharing of scientific information related to oil and hazardous substance spill response, identify spill response resources for the creation of a specialized equipment inventory and implement the 2013 Agreement on Cooperation on Marine Oil Pollution Preparedness and Response in the Arctic and related operational guidelines.

Marine Protected Areas

The Arctic Council will enhance PAME's work on a Pan-Arctic Network of Marine Protected Areas (MPAs). During the U.S. Chairmanship, PAME will: create an inventory and map of existing Arctic MPAs; perform a "desktop study" of area-based conservation measures and their linkages with categories of Arctic biodiversity to create a toolbox in support of MPAs and MPA networks; and identify examples and best practices for stakeholder engagement and communication as a part of the project on Meaningful Engagement of Indigenous Peoples and Local Communities in Marine Activities.

Ocean Acidification

The Arctic Council's initiative on ocean acidification seeks to achieve more comprehensive monitoring of ocean acidification throughout the Arctic Ocean. There are three main efforts to this initiative: expand the reach of the Global Ocean Acidification Observing Network (GOA-ON); increase the number of stakeholders trained to use and understand monitoring techniques, including from indigenous communities; and raise public awareness of the issue. This effort also is intended to contribute to and enhance the efforts to develop a second AMAP Arctic Ocean Acidification Assessment.

Clean Energy Access

Energy security and improved economic development for residents in remote Arctic communities can be strengthened through increasing the use of renewable energy and energy efficiency. The SDWG will work on exploring and developing projects which enhance energy security through these measures over the course of the U.S. Chairmanship and beyond. This work will include a project aimed at developing a modular system pairing renewable energy technology with diesel generators and energy-storage devices to power micro-grid systems in small Arctic communities. This project cluster may be expanded into a mechanism for clean energy practitioners to share knowledge and promote capacity building in rural communities. Other projects that address energy security in Arctic communities may also be added to this project cluster.

Water and Sanitation

Capitalizing on the results of the Alaska Water and Sewer Challenge, this project will focus on decentralized water and wastewater treatment, recycling, and usage efficiency. A workshop will be convened to facilitate collaboration between researchers, engineers, manufacturers, vendors and health experts on measures to increase access to, and reduce the operating costs of, in-home running water and sewer in remote communities, attract investment, improve public health, and spur public-private partnerships. The workshop will also serve as a platform to report on a circumpolar health assessment of existing community systems, water quality and quantity, utilization of traditional water sources and related health indicators.

Mental Wellness

The RISING SUN project (Reducing the Incidence of Suicide in Indigenous Groups—Strengths United through Networks) aims to create common metrics for evaluating suicide prevention efforts in the Arctic as a key component of scaling up and evaluating interventions across the circumpolar region. Complementing the mental health work completed under the Canadian Chairmanship, the common metrics, developed through engagement with Permanent Participants and community leaders, will aid health workers and policy-makers in measuring progress and identifying challenges by facilitating data sharing and pooling, evaluation, and interpretation across service systems.

Climate Resilience and Adaptation

The Arctic Council will advance our understanding of changes and vulnerabilities in the Arctic and support best practices for community and ecosystem resilience by completing the Arctic Resilience Report and Adaptation Actions for a Changing Arctic Part C assessment. In addition to supporting action on the ground, these two assessments will produce recommendations for the Arctic Council and national and sub-national governments. The Arctic Council will improve community-based environmental monitoring efforts through the circumpolar expansion of the Local Environmental Observers Network. It will also promote climate data sharing and will develop and promote decision-making tools and services, in part through the expansion of the Arctic Adaptation Exchange Portal. The Arctic Council will assess likely pathways for the introduction of invasive species as a result of climate change, and will develop a pan-Arctic action plan for preventing and managing these potential invasions. The Arctic Council will also draw upon efforts to institutionalize the "One Health" approach to enhance the underlying resilience of Arctic communities and ecosystems.

One Health

One Health is an interdisciplinary approach to assess health issues at the interface between humans, animals, and ecosystems. By the end of the U.S. Chairmanship, the SDWG will have taken steps to institutionalize the practice of One Health across the Arctic region, and will have contributed key findings to Arctic Council reports, as well as relevant meetings. Hubs will be designated to serve as Points of Contact (POCs) for the Arctic States and Permanent Participants. A circumpolar-agreed checklist will be developed to measure progress toward on-the-ground implementation of One Health, inform priority-setting, and facilitate non-expert engagement with the initiative.

Circumpolar Local Environmental Observers (CLEO) Network

The Arctic Council will expand the coverage of an existing Alaska-based monitoring tool, the Local Environmental Observer Network (LEO) that links traditional knowledge and scientific analysis, across the Arctic. Trained traditional knowledge experts are able to record their observations in the LEO database. These observations are reviewed by the Alaska Native Tribal Health Consortium (ANTHC), which serves as a secretariat. ANTHC is able to share observations of concern with regulators, academics and others who can in turn provide technical assistance to local communities when needed. During Phase I of the project, ACAP will create a North American CLEO "Hub," including indigenous communities in the Alaskan and Canadian Arctic for delivery to the 2017 Ministerial. In addition, we will explore the development of a framework for expansion of CLEO to the Nordic region. Phase II of the project is to establish a CLEO Hub in the Nordic region, as appropriate and explore options for linking with Russian indigenous communities. Phase III of the project will look at interoperability of CLEO Hubs and/or related observational networks. The CLEO project is also captured in the resilience project description.

Climate Change Indicator System

The Arctic Council will build on the set of climate change indicators currently under development by the United States Global Climate Change Research Program (USGCRP) to indicate the status and trends of change in key physical, biological, social, and economic parameters related to climate impacts and effects. This activity will involve all Arctic States and Permanent Participants to link a subset of indicators focused on climate change into a single pan-Arctic network, the Climate Change Indicator System for the Arctic (CCISA). Planned work includes contributing to the development of the framework for the CCISA and illustrating the potential for an Arctic Indicators Network by identifying a subset of Arctic-relevant indicators from the larger USGCRP effort.

Digital Elevation Model

The Arctic Council will promote the extension of the high-resolution pan-Arctic digital elevation model being developed for Alaska to the broader

Arctic to improve the quality of topographic information and capitalize on the Arctic Spatial Data Infrastructure (ASDI), an initiative led by the mapping agencies of the Arctic States.

Freshwater Synthesis

The Adaptation Actions for a Changing Arctic (AACA) will contain an Arctic Freshwater Synthesis (AFS). The AFS will examine issues such as: the role of freshwater in Arctic systems, historical changes to the Arctic freshwater system, and key drivers of such changes and projected changes to the Arctic freshwater system. The AFS will be the first-ever examination of the freshwater picture in the Arctic and could serve as the basis for a broader, in-depth Arctic Freshwater Assessment in the future.

Arctic Water Resources Vulnerability Index

This project will internationalize the University of Alaska-Fairbanks Arctic Water Resource Vulnerability Index (AWRVI) to provide Arctic communities with a valuable tool to assess the status of their freshwater resources. The expanded assessment will then feed into the Arctic Adaptation Exchange Portal, allowing local government officials, researchers and residents to evaluate their communities' freshwater resiliency and address vulnerabilities.

Telecommunications

The Task Force on Telecommunications Infrastructure in the Arctic, consisting of representatives of the Arctic States, Permanent Participants, the telecommunications industry, and end user groups, will provide the Council in 2017 with a circumpolar assessment of existing telecommunications infrastructure and networks potentially to include identification of unmet requirements and community needs (such as health services, broadband connectivity, scientific observations transmissions, and support for emergency search and rescue and oil spill response). The Task Force will aim to include, among other things, recommendations for public-private partnerships to enhance telecommunications access and service in the Arctic. The results of this assessment would be presented at appropriate international fora with a strong message from the Arctic States to make the

Arctic a top priority for future telecommunications investment.

Arctic Marine Cooperation

Arctic Council Ministers established the Task Force on Arctic Marine Cooperation to "assess future needs for a regional seas program or other mechanism, as appropriate, for increased cooperation in Arctic marine areas." Looking ahead to the future of the Arctic Ocean, the Task Force is assessing the needs for international cooperation to meet these future challenges and opportunities. Based on this needs assessment, the Task Force will make recommendations for new mechanisms for international cooperation, as appropriate, to meet these future needs.

Scientific Cooperation Task Force

The Scientific Cooperation Task Force is working on arrangements to improve scientific research cooperation among the eight Arctic States in the Arctic region, through discussions of shared concerns including access to data, access to scientific infrastructure and research areas, and simplification of movement of scientists and their equipment and samples. The Task Force is currently drafting the text of a legally binding Agreement on Enhanced International Arctic Scientific Cooperation, with a view to completing its work during the U.S. Chairmanship.

Black Carbon and Methane Expert Group

In order to understand trends in emissions of black carbon and methane in or near the Arctic, and to promote enhanced action over time, the Arctic Council launched an Expert Group to periodically assess the progress made under the Framework for Action on Black Carbon and Methane. Arctic States and participating Observer States will submit national reports on their existing and planned actions to address black carbon and methane, including national inventories. The Expert Group will analyze the national reports to draw conclusions and make recommendations for further voluntary action to be captured in a report to inform the Arctic Ministers in 2017. The work of the Expert Group will include identifying options for consideration in order to establish a collective baseline for black carbon emissions, as well as undertaking analysis and identifying options for quantitative goal(s) as described in "the common vision" of the Framework. The United States as the chair of the Expert Group also intends to convene a high-level policy forum to explore opportunities for further collaboration based on the above-referenced recommendations.

Points of Contact

Arctic Council: http://www.arctic-council.org/index.php/en/

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Commentary

Hugi Ólafsson

INTRODUCTION

The Arctic has been the subject of considerable and growing interest for the last two decades or so. The eight Arctic countries have all articulated Arctic policies and increased their policy coordination and cooperation, notably within the Arctic Council (AC). The outside world is paying close attention, as the dramatic environmental changes in the Arctic are of concern not only to Arctic states and inhabitants. Some see opportunities with new shipping routes opening in the Arctic as sea ice retreats. Most see trouble in news of thawing permafrost releasing methane, a potent greenhouse gas, and of accelerating melting of the Greenland ice cap. A total melt of Greenland ice cap could raise sea levels by 7 m. That would take centuries, but just a partial melt will spell disaster to Bangladesh, Florida, small island states, and other low-lying and vulnerable coastal areas.

Some, however, think that the excitement about the region may have peaked. “The hype over the Arctic recedes,” announced *The Economist* in January 2015. Falling oil prices mean less interest in drilling for oil and gas in the area, and make possible savings from shorter shipping routes slimmer. Only fifty-three ships plowed the Northern Sea Route in 2014, most traveling from one Russian port to another, down from seventy-one in 2013. Compare that to sixteen thousand transits through the Suez Canal. Arctic politics also seemed to be cooling with growing East-West tensions, the magazine claimed.

There may be some truth in this, but if a “hype” is deflating there are still solid reasons for keeping an eye on the Arctic in the long run. And in fact, the Arctic does not seem to be fading away from international discourse or getting neglected by the Arctic states themselves in the short term, either. The Arctic will most certainly be in the international spotlight in 2015.

One reason for this is the Paris climate meeting in December 2015—officially the Twenty-First Conference of the Parties of the United Nations Framework Convention on Climate Change (UNFCCC/COP21)—which is bringing the Arctic and its changing environment to the attention of world leaders. The United States has also brought a high political profile and an ambitious agenda to its newly started Chairmanship of the Arctic Council for 2015–17, focusing on issues such as climate change and economic and social development but perhaps most notably on ocean policy.

PARIS AND THE ARCTIC—A CRUCIAL MOMENT FOR CLIMATE CHANGE

It is not an exaggeration to say that the fate of the Arctic—and of the future of the planet—will be at stake at COP21 in Paris. If a workable agreement is reached at the December meeting, then there is some hope that humankind can start to curb emissions of greenhouse gases and prevent runaway climate change, perhaps even staying within the 2° Celsius stated goal of less-than-catastrophic warming since pre-industrial times. If not, then it seems likely that global temperatures will follow the scariest scenarios of the latest Intergovernmental Panel on Climate Change (IPCC) assessment, which predicts temperature increases around 3.7–4.8°C at the end of the twenty-first century and even more after that if emissions continue unabated.

Of course, there will be climate meetings after Paris, and other opportunities to reach an agreement. But after the failure to reach a deal on climate in Copenhagen in 2009, the Paris meeting will be a litmus test for global political will to make relatively modest short-term efforts to avert a climate disaster in the longer term. The global climate negotiations have been described as the most complex and resource-intensive negotiations in history; there is not infinite political capital to keep them going or infinite patience for missed deadlines.

Of course, even if an agreement is reached in Paris, even if it surpasses most optimistic expectations in terms of ambition, and even if its implementation will surpass the goals set, we will see the natural environment of the Arctic transform almost beyond recognition in this century. The *Fifth Assessment Report* of the IPCC paints a starker picture of warming in the Arctic than its predecessors. The Arctic is losing about a half-million square kilometers of sea ice per decade—that is about five Icelands/South Koreas/Kentuckys (take your pick!). The loss of ice is even greater than this if you look at summer ice instead of a yearly average or if you look at volume rather than area. It is "likely" (meaning greater than

66 percent chance) that the Arctic Ocean will be ice-free during part of the summer before 2050, according to the IPCC.

Warming has been twice as rapid in the Arctic as the global average, so even a 2°C global warming scenario will bring dramatic change to the Far North. In addition to the retreat of sea ice, most small glaciers in the Arctic region will probably disappear. Icelandic scientists predict the near-demise of Iceland's glaciers, now covering over 10 percent of the country, within 100–200 years. But staying within the 2°C global limit might avert the tipping point for the irreversible melting of the Greenland ice cap and halt the negative feedback loop of methane release from the thawing tundra. The stakes are high for the Arctic and the planet.

The Arctic needs success in Paris. But success in Paris also needs support from the Arctic science and policy community. This support can perhaps best be granted in two ways. First, Arctic states and other actors should engage in climate change mitigation. The U.S. chairmanship of the Arctic Council has "Addressing the Impacts of Climate Change" as one of its three thematic focus areas. It includes an emphasis on so-called short-lived climate pollutants (i.e., black carbon and methane). Targeting black carbon, mostly soot, seems particularly apt in an Arctic context, as it contributes to melting ice, and it is not a greenhouse gas dealt with under the UNFCCC.

Of course, the Arctic region itself contributes only a miniscule percentage of global greenhouse gas emissions, but it could demonstrate leadership in climate mitigation as an especially vulnerable region. This is what many small island developing states have done; Maldives, Dominica, Tuvalu, and others have announced plans to become carbon neutral or provide 100 percent of energy from renewables by 2020. In this context, it is interesting to note that the U.S. chairmanship program includes an emphasis on renewable energy under another of its three focus areas on "Improving Economic and Living Conditions in Arctic Communities." It is hard to see the eight member states of the Arctic Council engaging in a grand vision or a big investment program for transforming energy generation in the high north, but smaller steps could count in this respect and invite projects by interested parties. A country such as Iceland, which prides itself on 100 percent renewables for heating and electricity, could see an opportunity in exporting its expertise, in advancing climate-friendly solutions in other sectors such as transport and fisheries, and in framing them in an Arctic context.

The most important contribution of the Arctic to the global climate change debate is, however, not in limiting emissions or increasing renewable energy in the region. It is simply by providing a clear story of what is happening in the Arctic—a profound and unprecedented change in the climate and the physical environment—and shouting it to the world. The Arctic should be—and is already to a certain extent—*the* icon of climate change.

To insiders in the Arctic and/or climate change discourse, this may seem like an obvious truth. The IPCC has stated with increasing certainty that human-induced climate change is real, it is happening now, and it is happening especially fast in the Arctic. But to many decision makers, not to mention the media and the general public, the climate debate is still confusing and far from conclusive. A case in point is the high-profile story this summer of a possible upcoming "Maunder Minimum" in solar activity in the 2030s. "A small ice age arriving in 15 years" was the headline of the Icelandic Radio/TV station RUV, one of the most used and trusted media in Iceland. And the story was presented in a similar way in much of the global media. Leading climate experts were quick to point out that even given the maximum possible cooling effect of a solar lull, it would only provide a temporary 0.5°C "cooling" against a constant warming trend of perhaps 2–4°C this century. But it matters little. To the general public, it seems that scientists say one day that the planet is frying and the next day that we are heading for an "ice age." And this comes from the folks who have trouble predicting accurately the weekend weather. The logical conclusion is to worry about other things until those eggheads get their story straight.

But look at the Arctic. Here you see the story unfolding, clearly and visibly. The sea ice cover of the Arctic is arguably the best barometer we have for global climate change. The graph on the average Arctic sea ice extent in recent decades (see Figure I.1) should be a key graph in every presentation on climate change, along with the famous Mauna Loa observations graph showing rising carbon dioxide (CO_2) concentrations in the atmosphere.

World leaders seem to recognize this in linking the Arctic narrative to global climate talks. U.S. Secretary of State and AC Chair John Kerry will host a special high-level Arctic meeting on climate change in Anchorage, Alaska, at the end of August 2015. French President François Hollande is due to address the Arctic Circle conference in Reykjavík, Iceland in October, on the eve of COP21 in Paris. The Arctic Council's *Arctic Climate Impact*

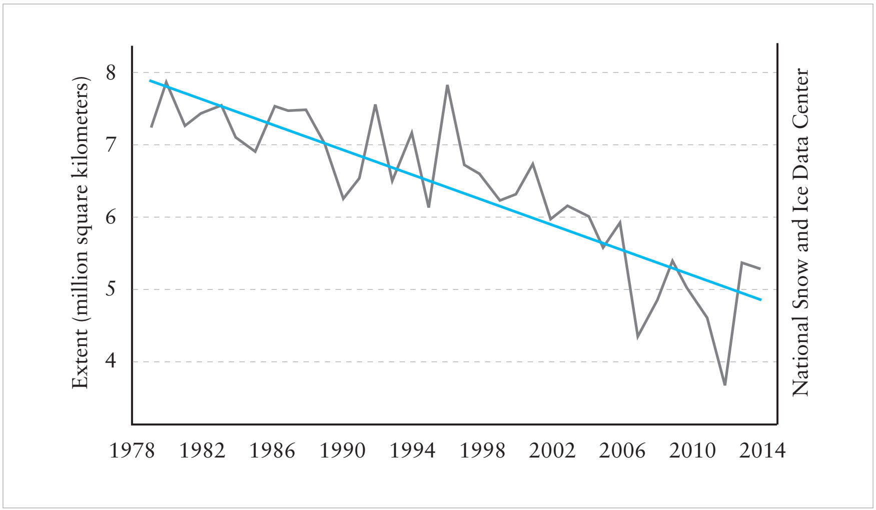

Figure I.1 Average Monthly Arctic Sea Ice Extent: September, 1979–2014

Assessment (ACIA) report did open the eyes of many upon its publication in 2004 to the fact that climate change was actually happening now and was not some future threat. Scientists and policy makers must continue to publicize their findings and key facts about the reality of climate change in the Arctic. Such a basic task is, sadly enough, sorely needed in a world awash with information and spin, where key facts and insights get lost if they are not pushed relentlessly. The world needs to know the Arctic story.

ARCTIC OCEAN STEWARDSHIP: A REGIONAL SEAS PROGRAM?

In the global context, climate change is *the* big Arctic issue. In the context of internal Arctic politics and policy, perhaps the most interesting development is the initiative of the U.S. chairmanship of the Arctic Council to upgrade cooperation on oceans affairs. "Arctic Ocean Safety, Security and Stewardship" is the third focus area of the U.S. chairmanship (the other two are mentioned above). This seems to be motivated not just by a need to check the "oceans" box for a region that is 70 percent water, but also by a genuine desire to move things further, both by individual projects in selected areas and by exploring the option of creating a "Regional Seas

Program of the Arctic Ocean."

For some, it might come as a surprise that the United States would put strengthening of governance in Arctic waters on the agenda. The U.S., alone of the eight Arctic states, has not ratified the UN Convention on the Law of the Sea (UNCLOS) or the UN Convention on Biological Diversity (CBD). To other countries, the U.S. often seems more comfortable with customary international law and informal multilateral regimes than treaties or similar arrangements. But a reading of the U.S. National Strategy for the Arctic Region shows a willingness to engage in Arctic affairs with ambition and new ideas. "We seek a collaborative and innovative approach to manage a rapidly changing region" is stated in the concluding chapter of the Arctic Strategy signed by President Obama.

This also fits well with recent statements and actions of Secretary Kerry, who took over the chair of the Arctic Council in April 2015. "Secretary Kerry has a profound interest in protecting the ocean and has made this a focus for American diplomacy," stated the U.S. Department of State official blog in August 2014. At the Iqaluit Ministerial in 2015, Secretary Kerry made an impassioned plea about the need to "galvanize action about our oceans, which are overfished and over-polluted and certainly over-acidified at this point."

It remains to be seen how the U.S. invitation to explore a regional seas program in the Arctic will be received by the other Arctic states. Certainly they have agreed to put this on the agenda, but in the recent past they seem to have been comfortable with less formal cooperation on ocean issues, notably within the confines of the Protection of the Arctic Marine Environment (PAME) working group, one of the six regular working groups of the AC. PAME concluded an "Arctic Ocean Review (AOR)" as recently as 2013, with the aim to "provide guidance to Arctic Council Ministers on strengthening governance" of the Arctic marine environment. The AOR outlined the patchwork of international, regional, and bilateral treaties and fora that already govern maritime affairs in the Arctic, and suggested a piecemeal approach to strengthen cooperation and governance in selected fields rather than a grand vision, such as seeking a regional treaty on Arctic seas.

Has anything changed since then? Well, certainly international discussions on ocean affairs are moving forward on many fronts. New concerns have surfaced, including the impact of plastic debris and acidification on marine life, the latter looking increasingly dire as our knowledge deepens. States and international bodies, under the guidance of CBD, are busy defining ecologically or biologically significant marine areas (EBSAs) that one day might form the basis for a global network of marine protected areas (MPAs). The OSPAR Commission has established MPAs outside national jurisdictions in the North Atlantic, the first time this has been done. Some see this as a model for establishing MPAs in the high seas areas of the Arctic. In 2017, the UN will perhaps start negotiating a global agreement on marine biodiversity beyond areas of national jurisdiction.

So, there is no shortage of issues to be discussed and tackled in the marine field. Most are in fact already being addressed by the Arctic Council, including MPAs. So what would a regional seas program, to be defined during the U.S. chairmanship, precisely entail? What form would it take? How would it affect the current AC structure dealing with the marine environment?

Secretary Kerry gave some hints on this in his remarks presenting the U.S. Chairmanship Program in Iqaluit: "we can also create a regional seas program for the Arctic, something that nations have done in other parts of the world to improve cooperation on marine science and share best practices." Possible blueprints for such a program might be some of the thirteen "Regional Seas" programs under the auspices of UNEP (some of which are directly administered by UNEP), or regional conventions such as the Barcelona Convention for the Mediterranean or the Helsinki Convention for the Baltic Sea. Some have pointed to the OSPAR Convention for the Protection of the Marine Environment of the North-East Atlantic as the most obvious model for the Arctic, as it already covers a slice of Arctic waters and includes five of the eight AC member states as parties.

The establishment of a full-fledged regional convention on Arctic waters appears, however, to be perhaps a step too far for the Arctic countries to take in the near future, judging by past reactions to such ideas. At the other extreme, one could imagine that a regional seas program would simply use already established bodies and structure, with policy questions on MPAs, shipping, etc. tackled by PAME, and beefed-up scientific monitoring and assessments of marine pollution, acidification, etc. addressed by AMAP and other working groups of the AC. Or perhaps some in-between arrangement will be found. The mandate of the new task force to "explore how collaborative efforts in the Arctic marine environment might be enhanced and what mechanism(s) might be appropriate" is broad enough to explore many options.

There are some contentious issues that might complicate this discussion. One is the question of the role of the AC versus other fora. The Arctic Council has definitely been the main forum for internal discussions of Arctic countries regarding marine issues. Since 2008, there have also been occasional meetings of five states bordering the central Arctic Ocean—United States, Canada, Russia, Norway, and the Kingdom of Denmark—on selected issues related to that ocean. Iceland (and Finland and Sweden to a lesser degree) is unhappy about being excluded from meetings of the Arctic Five. After a quiet period for this forum, a moratorium of fishing in the Arctic high seas was announced at a meeting of the Arctic Five held in Oslo in July 2015. Iceland formally complained about this afterwards, citing a number of reasons why it should be consulted on the issue of fisheries in Arctic waters, including Iceland's geographical position and reliance on and knowledge of fisheries. Pretty much no one expects fisheries to develop in the central Arctic Ocean any time soon, if ever, so it can be argued that the announcement was less than historic, and an easy way to get credit from conservationists. The issue of the Arctic Five versus the Arctic Council might, however, come up in discussions about an Arctic regional seas program. And what of non-Arctic states? They will most certainly have a keen interest in discussing their possible role in the development and management of such a program.

Another broader issue is that Arctic states have different approaches to ocean affairs, which could in a simplified way be described as assigning different weights to conservation versus utilization of marine resources. This difference is actually not only confined to states, but to most stakeholders in the Arctic discourse, inside and outside the region itself.

These differences show themselves *inter alia* in discussions about marine protected areas. Each Arctic state has a different approach to MPAs; some have advanced legislation and a well-defined domestic network of MPAs, while others have moved cautiously. Some permanent participants representing indigenous peoples in the Arctic Council are also apprehensive with regard to MPAs, suspecting perhaps a heavily conservationist ideology behind their establishment rather than a sustainable-development approach. Official definitions of MPAs, such as by the International Union for Conservation of Nature and Natural Resources (IUCN), do not preclude various types of use within their confines. Advocates of MPAs often point out that they are by no means synonymous with "no-take zones" and even claim that they can bring economic benefits, e.g., by promoting ecotourism or boosting fisheries by providing safe havens for valuable fish stocks to hatch and grow up before swimming into less-protected waters. MPAs can be as diverse as protected areas on land—ranging from strict nature reserves to areas promoting sustainable use of resources—but their development worldwide, both in methodology and area, lags far behind that of their terrestrial counterparts.

Will the issues discussed above, or other concerns and differences of opinion, put a stop to the ambition of the U.S. chairmanship to make progress in ocean affairs? That would seem unlikely. Even the states and stakeholders who are most cautious should welcome a chance to have a more rigorous discussion on various marine issues in the Arctic Council. Those concerned about the Arctic Five should welcome a strengthened discussion on ocean affairs under the auspices of the Arctic Council. Those who are skeptical about MPAs or stricter conservation measures in the Arctic might find it easier to make their concerns felt in a small regional body than in global fora.

Most importantly, the discussion about an Arctic regional seas program does not start with a blank slate. PAME and the other AC working groups have fostered a close-knit network of experts in various fields of marine science and policy making for a long time. The Arctic states and permanent participants know each other's views and sensitivities pretty well. Work on potentially contentious issues, such as on a network of MPAs, has already been launched; the Iqaluit Ministerial adopted the PAME report, *Framework for a Pan-Arctic Network of Marine Protected Areas*, as well as the PAME work program which outlines next steps in this work. PAME, and the AC in general, has a long track record in dealing with new concepts and potentially contentious issues. Experts have discussed ecosystem-based management (or "ecosystem approach") for many years and have defined large marine ecosystems in the Arctic and a step-wise methodology for applying an ecosystem approach by Arctic states.

Perhaps most importantly, the Arctic Council adopted, in Iqaluit, a new Arctic Marine Strategic Plan (AMSP) to guide the work of the Arctic Council in marine affairs until 2025. This PAME-led work replaces a former AMSP, which served as a basis for the work of the AC on the oceans for the last ten years. The AMSP outlines how the council can increase its understanding of the impacts of human activities, climate change, and ocean acidification and lists several "strategic actions" to be taken by the

AC and its working groups in the coming years.

So what can a regional seas program achieve that the Arctic Council cannot do with a newly adopted Arctic Marine Strategic Plan, a busy and wide-ranging marine policy agenda in PAME, and several ocean-related scientific monitoring and assessment projects in other AC working groups? That, of course, remains to be seen. But even if it did little but incorporating already existing initiatives under a new name, it would signal a more serious role for the Arctic Council and the eight Arctic states in dealing with ocean affairs. It would invite comparisons with other regional seas programs and conventions, a definition of its status and discussions about how it fits into the Arctic Council structure. It would signal a desire to move faster and further to strengthen cooperation in the Arctic on marine issues.

CONCLUDING REMARKS

Interest in the Arctic may wax and wane depending on oil prices, yearly sea ice status, geopolitical concerns, and other factors. But the Arctic will remain central in the global debate on climate change and will continue to generate great interest in connection with the COP21 climate meeting in Paris at the end of 2015 and in its aftermath.

Internally, the incoming U.S. chairmanship of the Arctic Council will bring a high political profile plus some fresh ideas to regional cooperation. Introducing the concept of a “regional seas program” in the Arctic will cause much discussion on the form and substance of Arctic cooperation on marine issues.

In a consensus-based political forum, it seems safe to predict that progress on an ambitious Arctic oceans agenda will be slower than hoped for by those who want fast results. But the Arctic Council is a small body and already has a tight network of experts to deal with new ideas as well as existing projects, so it also seems unlikely that this initiative will be stalled. The cooling of relations between Russia and the West over Ukraine has affected Arctic Council work to some extent, but there seems to be little appetite on either side to let it freeze progress in the Arctic Council. So there is every reason to be optimistic about positive results from a discussion on a regional seas program. Indeed, it may even result in a fertile exchange of ideas and identification of best practices that may inform current global discussions on the oceans.

The rapid environmental change in the Arctic demands a strong response in preparing for a future with less ice, more human activity, and a myriad of threats and opportunities. It requires rigorous science, clear assessments, and responsible policymaking based on facts and respect for both the fragile nature of the Arctic and the livelihoods and aspirations of its inhabitants. An agenda designed to step up work on marine issues and other tasks in the Arctic Council seems both timely and right.

Commentary

Sung Jin Kim

INTRODUCTION

It has been almost thirty years since changes in the international political environment and climate change propelled the Arctic region into the center stage of global interest. The year 2016 will mark the twenty-fifth anniversary of the adoption of the Arctic Environmental Protection Strategy by Arctic states to address changes in the Arctic's natural environment as well as the twentieth anniversary of the foundation of the Arctic Council as an intergovernmental forum.

Changes in the Arctic have proceeded faster than the international community had expected. Due to climate change and global warming, the world's glaciers are declining, and the reduction of Arctic sea ice and snow cover during spring in the Northern Hemisphere is occurring faster and more broadly than in other regions. As a result, the Arctic Ocean and its ecosystems have undergone significant changes that now make it practicable to operate oil and gas development projects in the region, and reductions in Arctic sea ice are opening up the possibility of commercial shipping in the region. Also, rising temperature is leading to losses from Greenland's ice sheet, and there is a growing likelihood that the marine ecosystem will be under threat from the acidification of oceans due to an increase in the level of carbon dioxide (CO_2). These challenges are not resolvable by the Arctic communities and indigenous populations alone. New measures to manage the high seas, where the reach of the international law remains limited, are being put forward. But overall, a systematic management of Arctic activities and changes is still lacking. The Arctic presents us all with difficult social and economic challenges that we must solve, but also with new opportunities and possibilities. In this regard, there is growing consensus on the necessity of establishing a more constructive and efficient framework for cooperation and governance structure that promotes the interests of all stakeholders. Furthermore, global action is required for the joint effort in addressing new challenges faced by indigenous communities, who are the Arctic's most important stakeholders; dealing with the possibility of conflict surrounding resource development and environmental preservation; and the building and financing of infrastructure for sustainable development. Therefore, a more open consultation process should be established to allow observer states to make use of their various capabilities to make positive contributions to address those challenges.

Against this backdrop, the policy agenda of the United States for the Arctic Council is the object of focused attention as it assumes the chairmanship of the council this year. This essay, based on the author's personal assessment, examines the significance of the US program for the Arctic Council and provides an overview of possible areas of cooperation for South Korea as an observer state.

U.S. CHAIRMANSHIP OF THE ARCTIC COUNCIL

The theme of the U.S. chairmanship of the Arctic Council is "One Arctic: Shared Opportunities, Challenges, and Responsibility," which emphasizes the sharing of opportunities to use goods and services provided by the Arctic in a sustainable way together with our common responsibility and joint action against climate change and environmental impacts. It is the author's personal opinion that the U.S. policy is accommodating increasing Arctic interests from both the Arctic and non-Arctic states, and providing an appropriate basic policy direction, taking into account the vast geophysical boundaries of the region as well as its interconnectivity with the Earth's systems.

The broad theme has three focus areas: "Improving Economic and Living Conditions for Arctic Communities"; "Arctic Ocean Safety, Security and Stewardship"; and "Addressing the Impacts of Climate Change." Under each of the focus areas, more specific program-level agendas are identified.

Under "Improving Economic and Living Conditions for Arctic Communities," renewable energy, freshwater security, and telecommunications-infrastructure assessment particularly stand out. These are "good technologies" that should be actively promoted, as they provide the necessary foundations for living in the Arctic, and are applicable to other similarly remote areas in the world. However, the most important policy challenge will be to find ways to finance the large initial investment cost of these technologies, which market forces alone cannot solve. Some possible alternatives could be utilizing existing technologies or introducing converged technologies in designated test bed sites in some countries, and encouraging voluntary involvement and harmonious cooperation of relevant experts and technicians.

"Arctic Ocean Safety, Security and Stewardship" is another focus area that is significant in that it takes a precautionary approach toward the expected increase in the use and development of the Arctic Ocean. Reductions in Arctic ice and increases in the demand for Arctic resources, commercial shipping-route establishment, tourism-route development, and offshore-plant project expansions, are some inevitable changes that are expected to occur in the future. A common effort by the international community regarding these issues is called for. Deserving of further examination are the establishment of a network of marine protected areas, a "Regional Seas" program, and the implementation of the 2013 "Agreement on Cooperation on Marine Oil Pollution, Preparedness, and Responses in the Arctic."

Considering the environmental sensitivity and shortcomings in Arctic disaster response, these are precautionary measures that must be carried out. But at the same time, challenges of implementing such measures should be continuously discussed. A mid- to long-term perspective would be required in some areas as well. For example, in order to establish a network of marine protected areas, cooperation among coastal states in possession of territorial waters and exclusive economic zones (EEZs) needs to be prioritized, and a common awareness of the need to protect shared species and ecosystems must be established. Setting up a new international marine protected area in the high seas will require the cooperation and sharing of understanding among coastal states and non-coastal states, as well as the participation of multilateral organizations such as the International Maritime Organization (IMO) and Convention on Biological Diversity (CBD). In that aspect, it would be desirable to initiate a continuous and systematic discussion of such issues involving various relevant stakeholders within the Task Force on Arctic Marine Cooperation, as promoted by the United States.

Furthermore, discussions also should involve the Arctic Economic Council in order to connect it with long-term economic activities. Papers and the know-how accumulated by the North Pacific Arctic Conferences (NPACs) so far will greatly help in facilitating the process for such discussions.

The "Regional Seas" program could contribute to creating new governance for the management of the Arctic environment, including the high seas. In particular, the much-noted recent issue of commercial fisheries in the high seas could be discussed here. How the views of some of the important participants of the Arctic Council such as non-littoral states, indigenous peoples' groups, and observer states are reflected in the discussions will be important. On that note, it is hoped that the US chairmanship will take on a leadership role that is flexible and provides opportunities for observer states to be included in the discussion. NPAC can make important contributions in that regard as well.

It is hoped that through the implementation of the 2013 Agreement on Cooperation on Marine Oil Pollution, Preparedness, and Response in the Arctic practical measures in response to oil spills, which is the biggest threat for the Arctic Ocean, will be established. For this to happen, not only the Arctic states, but related stakeholders from the industry such as oil companies, shipping companies, and insurance companies, must be included in the discussion. The establishment of a cooperative mechanism for safety inspection at destination ports is also needed. Major non-Arctic maritime nations should be provided with venues to responsibly participate in discussions over the implementation of the International Code for Ships Operating in Polar Waters (Polar Code), which will come into effect in 2017.

"Response Measures against Climate Change" is one of the oldest agenda items of the Arctic Council. Yet due to the difficulty of obtaining desired results through a regional response, much of the action against climate change has centered on limited monitoring activities and adaptation efforts. Thus the setting of reduction targets for short-lived climate pollutants, such as black carbon and methane, is a significant step forward in the effort to reduce climate-change-inducing factors in the Arctic. These measures may be difficult to push forward, since they will have direct consequences for economic activities in the Arctic region; most of the pollutants come from regions outside the Arctic; and action against naturally occurring phenomena such as forest fires and the thawing of permafrost may be pointless. However, the development of long-term response measures is nevertheless needed. First and foremost, opportunities for exchanges among scientists need to be expanded and vitalized so that diverse opportunities for cooperation in the area of pure science are created. For instance, cooperation with scientific communities from the Pacific region, such as the **North Pacific Marine Science Organization** (PICES) and the Pacific Arctic Group (PAG), could be strengthened.

In addition, creating the Pan-Arctic Digital Elevation Map will serve as a very useful tool in analyzing and predicting general climate change impacts by helping to measure changes in snow and ice as well as erosion of coastal areas. Hopefully further efforts will make it possible to apply the same methodology to observe three-dimensional changes in the Arctic sea ice.

KOREA'S AREAS OF POSSIBLE COOPERATION

It is true that the Republic of Korea (hereinafter "Korea") lacks the capacity to respond comprehensively to Arctic challenges. Nevertheless, the country has various qualities that make it a suitable Arctic partner. For example, the country borders both the Pacific Ocean and the Eurasian continent and is geographically located to affect and be affected by the Arctic; the country has no geopolitical ambitions in the Arctic region. Korea has a democratic political and financial system; an economic system based on free-market principles; advanced circumpolar research facilities and experiences (including an icebreaker); accumulated knowledge in ship building, communications, and construction technologies; and demonstrated leadership as a middle power. Furthermore, the Korean government has displayed strong political will to foster cooperative ties with Arctic states, such as by formulating the Master Plan for Arctic Policy, as well as an action plan, which is something rare for an observer state. Korea is implementing the plan by participating in the activities of the Arctic Council's working groups and by expanding discussions of bilateral cooperation with more partners. Regarding future U.S. policy for the Arctic Council, the author proposes possible areas for cooperation for Korea.

First, Korea should strengthen cooperation in the area of exchanging Arctic information. Inaccurate and false information about the Arctic will negatively affect policy-making and decision-making processes. Surveys could produce contrasting results, and regional differences can influence outcomes. Socioeconomic information should be shared in order to allow for preemptive action against possible adverse impacts on communities. In light of this, the First International Seminar on Arctic Information and Knowledge was held on 7 July 2015, in Korea, which was attended by relevant organizations from the five Arctic states (United States, Canada, Iceland, Sweden, and Finland), and representatives from Conservation of Arctic Flora and Fauna (CAFF), Protection of the Arctic Marine Environment (PAME), and Aleut International Association Seeing the need for information sharing, participants agreed to further cooperate on this front. In the future, more effort should go into fostering cooperation in sharing accurate information to enable sustainable development of the Arctic. The United States has assumed the chairmanship of the Arctic Council at an important time. As such, it is suggested that the United States open up opportunities to a broad range of participants and expand areas for mutual cooperation as well as develop a new agenda.

Second, there is a possibility for strengthened cooperation in the area of scientific research and observation. The Korea Polar Research Institute (KOPRI) annually conducts joint scientific surveys with relevant countries in the Bering Sea and the Arctic Ocean using its icebreaking research vessel, the Araon. It also obtains weather data from the Chollian satellite. Ways of utilizing these survey and observational data for the activities of the Arctic Council's marine environmental protection and climate change response efforts should be sought. In particular, undertaking scientific research in the high seas in the future will absolutely require an ice-breaking research vessel, and many contributions could be made if active bilateral cooperation is forged. Korea, for its part, will provide more support to its scientists and create an environment allowing them to become more actively involved in Arctic research activities.

Third, cooperation with the Arctic Economic Council (AEC) could be examined. The Korean government and relevant Korean companies are interested in the Northern Sea Route and are looking for ways to promote sustainable shipping in this region. In this sense, the IMO Polar Code is expected to make important contributions, and the recent election of a South Korean expert as the new IMO secretary-general will help present Korea's intention to pursue responsible shipping in a positive light. While much research is being conducted on the economic feasibility of the Northern Sea Route, there is little opportunity to share this research. Thus, it is proposed that PAME take the lead in managing an international research project on this issue. In addition, proactive participation of the Russian government and its relevant institutions are expected, since broad understanding and cooperation by Russia will be important as the country will have an important role in operating any Arctic shipping route.

Fourth, it is proposed that the agenda set forth by the United States be shared with Korea's future generations. Korea Maritime Institute, one of the hosts of the NPAC, has established a "Korea Arctic Academy," which is co-hosted by the University of the Arctic, and funded by the Korean Ministry of Oceans and Fisheries. Eleven students from seven Arctic states and nineteen Korean students from eight different universities and research institutes will gather in Busan on 17 August 2016 for seven days, to discuss and exchange thoughts on Arctic social, economic, and cultural issues. It would be meaningful to have the theme for next year's Academy be "Arctic Ocean Safety, Security and Stewardship."

Finally, it cannot be stressed enough that issues related to the Arctic are by nature not simple. They are interrelated with biophysical, legal, institutional, and socioeconomic factors in a complex way. Therefore, it will be important to establish a cooperative system to manages all these issues and help produce fruitful outcomes. Hopefully, a platform will be provided for the discussion of various proposals, which are based on presentations given by Young for the past few years and reviewed at NPAC, among Arctic and non-Arctic states as well as all other related stakeholders including nongovernmental organizations.

Commentary

Jiang Ye

INTRODUCTION

From April 2015 to the spring of 2017, the United States will chair the Arctic Council (AC). Based on the "National Strategy for the Arctic Region" issued by the Obama Administration on 10 May 2013, the U.S. government has announced an ambitious program for its two-year term as chair of the AC. According to the materials provided by the U.S. Department of State, the theme of the U.S. chairmanship of the Arctic Council (AC) is "One Arctic: Shared Opportunities, Challenges and Responsibilities," a formulation which recognizes the peaceful and stable nature of the Arctic.[1] Up till now, the United States has developed an ambitious and balanced program for its chairmanship. Just as Young has pointed out, most of those who have commented on this program have focused on what the U.S. describes as "thematic areas," including the impacts of climate change, stewardship of the Arctic Ocean, and economic and living conditions in the Arctic.[2] According to the U.S. official document, "improving economic and living conditions" comes first and "addressing the impacts of climate change" comes last but not least.

As a Chinese scholar, I am interested in analyzing how China can play a role in Arctic affairs during the U.S. AC chairmanship with such an ambitious program. It is not because most Chinese scholars working on the Arctic affairs think that China is a country near the Arctic region. I myself do not like to use such explanations. The main reason for me to be interested in this topic is that China has already been involved in Arctic affairs which have had close linkages to global affairs in an integrated world for a long time. The current relations between China, the second largest economic entity, and the U.S., the largest economic entity as well as the only superpower in today's world, have expanded to all areas of global affairs. In order to promote the China-U.S. political, economic, cultural, and environmental relationship for stable and healthy development in the world, we need to study and analyze the relations between the two from an all-round perspective and try to understand the concerns, positions, and appeals of each other in different fields and areas, including Arctic affairs.

CHINA'S STANCE IN ARCTIC AFFAIRS

As an emerging power China has already been actively participating in global affairs including Arctic affairs, especially in efforts to deal with climate change. Such a situation clearly explains why China was active in Arctic affairs and Arctic governance even before becoming a formal observer in the Arctic Council. China will undoubtedly play a more active role in Arctic governance since gaining observer status in the AC in May 2013. It follows that understanding China's stance in Arctic affairs becomes critical in deliberating China's role in Arctic governance during the U.S. AC chairmanship from 2015–17.

First, China recognizes and respects the rights of the Arctic coastal states in the region in accordance with the United Nations Convention on the Law of the Sea (UNCLOS) and other relevant international laws. China fully agrees that Arctic states have sovereign rights and jurisdiction in their respective areas in the Arctic region, and China will not interfere with Arctic states' inner affairs or bilateral negotiations on boundaries, border disputes, and other jurisdictional issues. Thus, "in terms of handling Arctic affairs we should respect sovereignty, sovereign rights, and jurisdiction of Arctic countries from the basic foreign policy of peaceful development of China, and gradually eliminate doubts about our participation in the Arctic affairs."[3]

Second, given the global implications of certain Arctic issues such as climate change etc., as a non-Arctic state affected by developments like melting icecaps in the Arctic region and new shipping routes, China contends that it has the responsibility to provide public goods in Arctic governance treated as part of global governance. China also believes that both Arctic and non-Arctic countries play an indispensable role in Arctic governance in the context of global governance. As a non-Arctic state, China has to cooperate with Arctic states on the basis of UNCLOS and through participating in the activities of the Arctic Council as a permanent observer state. China believes that the AC is the most influential regional intergovernmental forum.[4] Already as a temporary observer of the AC, China had appreciated the opening of AC to non-Arctic countries. Since becoming a permanent observer state, China has worked and will continue to work hard to strengthen cooperation with AC and its member states, increase mutual understanding and trust on Arctic affairs, and improve Arctic governance.

Third, scientific research in the Arctic is a priority for China's participation in Arctic affairs, and China believes that enhanced cooperation in scientific research will enable Arctic and non-Arctic states such as China, Korea, and Japan to view transregional issues from a global perspective and to facilitate the settlement of relevant issues. This model of cooperation has already yielded sound results for China in addressing such issues as climate change, Arctic marine environment, Arctic shipping, etc. The Yellow River Scientific Research Station established by China in Svalbard in 2004 has already been cooperating with countries such as Norway, the United States, and other non-Arctic states such as Germany, Korea, and Japan. China is also active in the International Arctic Science Committee (IASC), providing one of the deputy chairs.

ADDRESSING CLIMATE CHANGE IS THE MAIN AREA WHERE CHINA WILL CO-OPERATE WITH THE UNITED STATES IN ARCTIC AFFAIRS DURING THE U.S. AC CHAIRMANSHIP

One of three crucial areas in the U.S. program for its AC chairmanship is to address the impacts of climate change. China is able and willing to cooperate with the United States in this area during its AC chairmanship. The reasons are as follows:

- Both China and the United States are committed to responding actively to climate change. On 12 November 2014, the People's Republic of China and the United States of America issued a "China-U.S. Joint Announcement on Climate Change" in Beijing stating their respective post-2020 goals for coping with climate change. This announcement states that "the United States intends to achieve an economy-wide target of reducing its emissions by 26 percent to 28 percent below its 2005 level in 2025 and to make best efforts to reduce its emissions by 28 percent."[5] According to the announcement, "China intends to achieve the peaking of carbon dioxide emissions around 2030 and increase the share of non-fossil fuels in primary energy consumption to around 20 percent by 2030."[6]

  The joint announcement also states that China and the United States "intend to continue strengthening their policy dialogue and practical cooperation, including cooperation on advanced coal technologies, nuclear energy, shale gas, and renewable energy, which will help optimize the energy mix and reduce emissions, including from coal, in both countries."[7] With this in mind, it seems China will collaborate with the United States in achieving all goals in the area of addressing the impacts of climate change in the Arctic region during its AC chairmanship. These include: "Targeting short-lived climate pollutants, Supporting Arctic climate adaptation and resilience efforts, and Creating a Pan-Arctic Digital Elevation Map."[8]

- The AC has already played a substantial role in dealing with climate change in the Arctic region, and China and the United States can cooperate quite well through the council in addressing impacts of climate change during the U.S. AC chairmanship. The Arctic Council issued the Arctic Climate Impact Assessment report in 2004, and the Arctic Monitoring and Assessment Programme (AMAP) issued the Snow, Water, Ice, and Permafrost in the Arctic report in 2011. It is quite clear in the period of the U.S. chairmanship that the council will be well-placed to continue making significant contributions of this sort. Since becoming an AC permanent observer the Chinese government has sent different scientists and experts to participate in the activities of working groups addressing climate change issues in the council, such as the working group on Conservation of Arctic Flora and Fauna (CAFF), the Arctic Monitoring and Assessment Programme (AMAP), and the Arctic Contaminants Action Program (ACAP). China's performance in those working groups and programs has been praised by peers in the council. Without doubt, Chinese scientists and experts cooperate more actively with their counterparts in the working groups and programs of the AC in dealing with impacts of climate change in the Arctic region during the U.S. AC chairmanship.
- Most of China's scientific activities in the Arctic region have been related to addressing climate change. Up till now, China has conducted six marine scientific expeditions in the Arctic—in 1999, 2003, 2008, 2010, 2012, and 2014—and has carried out comprehensive and multi-disciplinary observations on the sea, snow and ice, atmosphere, biology, and geology. China implemented the "China Polar Action Plan" during the International Polar Year (IPY) from 2007 to 2010, which demonstrated the cooperation between

> China and countries within Arctic region as well as outside the Arctic region. China conducted these research programs as rapid changes caused by climate change took place in the Arctic region and participated in international Arctic scientific expeditions and several international Arctic science programs. China attaches great importance to Arctic environmental protection and to the impact of climate change there as well. China is an active member and facilitator in the international effort to address climate change. China is the first developing country to enact a "National Action Plan on Climate Change." Being a party to relevant international conventions regarding Arctic environmental protection, China is faithfully implementing its obligations. China's Arctic scientific research mainly focuses on Arctic climate change and its role in global climate change along with the dynamic processes of the Arctic Ocean and its impact on global ocean circulation, Arctic environmental processes, and ecosystem evolution. As these initiatives show, China will cooperate actively with the U.S. during its AC chairmanship from 2015 to 2017.

CHINA WILL COOPERATE WITH THE UNITED STATES IN IMPROVING ECONOMIC AND LIVING CONDITIONS IN ARCTIC COMMUNITIES AND IN "ARCTIC OCEAN SAFETY, SECURITY AND STEWARDSHIP"

According to the U.S. official documents, "remote Arctic communities face a number of threats to the health and well-being of their citizens, including food and water security, safe water, sewer and sanitation, affordable and renewable energy, adequate mental health services, and the need to ensure the continued economic viability of their communities."[9] That is the main reason why the U.S. put the area of "Improving Economic and Living Conditions in Arctic Communities" in the first place in the program for its Arctic Council chairmanship.

It is interesting that Ambassador Jia Guide, the former Deputy Director General of the Department of Treaty and Law, Ministry of Foreign Affairs of China, who led the Chinese delegation during the Sixth Round Dialogue on the Law of the Sea and Polar Issues between China and the U.S. held in Seattle 8–9 April 2015, mentioned the factor of indigenous peoples in China's Arctic policy in an article entitled "On China's Participation in Arctic Governance under New Circumstance" published recently in Global Review, an academic journal sponsored by the Shanghai Institutes for International Studies. He expressed the view that while participating in Arctic affairs, China needs to "attach importance to indigenous factors in the Arctic affairs, fully understand, respect for indigenous people in the aspect of environmental protection, the apprentice, the distribution of economic benefits, as well as strengthen the communication and cooperation with them in order to promote the well-being of the Arctic people and the sustainable development in Arctic region."[10]

Although China has not yet issued its official Arctic policy paper, what Ambassador Jia's statement regarding the well-being of Arctic peoples shows that China wishes to cooperate with all people especially indigenous people in Arctic region in promoting their economic and living conditions. So it is likely that China and the U.S. can cooperate in pursuing some of the goals the United States has articulated in the area of "Improving Economic and Living Conditions in Arctic Communities," including "Promote the development of renewable energy technology, such as modular micro-grid systems, to spur public-private partnerships and improve energy affordability," etc.[11]

As we know that China fully agrees that the Arctic states have sovereign rights and jurisdiction in their respective areas in Arctic, China will not interfere with the Arctic states' inner affairs and the bilateral or multilateral negotiations on boundaries, border disputes, and other jurisdictional issues among Arctic states. China has no intention to get involved in any traditional security affairs in the Arctic region because China has no national interests there. In terms of the nontraditional security issues in the Arctic region such as "Arctic Ocean Safety, Security and Stewardship," the second goal the United States includes in the program for its AC chairmanship, China will try its best to cooperate with Arctic countries including the United States.

In 2015, the International Code for Ships Operating in Polar Waters (Polar Code) was adopted by the International Maritime Organization (IMO), constituting an historic milestone in IMO's work to protect ships and people aboard them, both seafarers and passengers, in the harsh environment of the waters surrounding the two poles. China is one of the leading members of IMO and has contributed substantially to the development of the Polar Code. During the process of drafting and formulating the Polar Code, an expert group from China persisted in the maintenance of shipping safety and improvement of the environmental protection, considered keeping balance between existing technology and future development needs, and tried to maintain balance between interests of countries in and outside the Arctic region so as to provide reasonable proposals.[12]

Given the role of China in the IMO and especially the contribution of China in creating the Polar Code, it is reasonable to expect that China will cooperate well with United States in enhancing the ability of Arctic states to execute their search and rescue responsibilities and in emphasizing safe, secure, and environmentally sound shipping in the Arctic Ocean. China will also support the U.S. in efforts to ensure that future maritime development avoids negative impacts, particularly in areas of ecological and cultural significance in the Arctic. Although China is not an Arctic state, as a permanent observer in the AC, China will support the aims of the U.S. in the area of "Arctic Ocean Safety, Security and Stewardship," such as "Better prepare those responsible to better address search and rescue challenges in the Arctic," "Ensure marine environmental protection, including working toward the establishment of a network of marine protected areas," etc.[13]

CONCLUSION

China's stance in Arctic affairs comprises three parts. They are: first, recognizing and respecting the rights of the Arctic coastal countries and countries in the region; second, accepting that China has the responsibility to provide public goods in Arctic governance; and third, treating scientific research in the Arctic as a priority of China's participation in Arctic affairs. With this stance in mind, it is easy to understand that addressing climate change is the main area for China to co-operate with the U.S. in Arctic affairs during the U.S. AC chairmanship from 2015 to 2017. The main reasons are: first, both China and the U.S. are already committed to actively responding to climate change; second, the AC has already played a substantial role in dealing with climate change in the Arctic region; third, China and the U.S. can cooperate quite well through the Council in addressing impacts of climate change; and fourth, most of China's scientific activities in Arctic region have been related to addressing climate change. Besides climate change, China will also cooperate actively with the U.S. in improving economic and living conditions in Arctic communities and in Arctic Ocean safety, security, and stewardship

Notes

1. Robert W. Corell, "U. S. Chairmanship of the Arctic Council"—summary created from materials provided by the U.S. Department of State.
2. Oran R. Young, "The U.S. Arctic Council Chairmanship, 2015–2017: A Scientific Persctive," commentary prepared for presentation at the 2015 North Pacific Arctic Conference, Honolulu, Hawaii, 5–7 August 2015.
3. Jia Guide and Shi Wuhong, "On China's Participation in Arctic Governance under New Circumstance," *Global Review* (Guoji Zhanwang, CN31-1041/D, July/August 2014): 27. Jia Guide was formerly the deputy director general of the Department of Treaty and Law, Ministry of Foreign Affairs of China, and led the Chinese delegation attending the 6th Round Dialogue on the Law of the Sea and Polar Issues between China and the United States (Seattle, 8–9 April 2015).
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5. "U.S.-China Joint Announcement on Climate Change," Beijing, China, 12 November 2014, https://www.whitehouse.gov/the-press-office/2014/11/11/us-china-joint-announcement-climate-change.
6. "China- U.S. Joint Announcement on Climate Change," Beijing, China, 12 November 2014, http://www.china.org.cn/chinese/2014-12/09/content_34268965.htm.
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8. Robert W. Corell, "U.S. Chairmanship of the Arctic Council"—summary created from materials provided by the U.S. Department of State.
9. Robert W. Corell, "U.S. Chairmanship of the Arctic Council"—summary created from materials provided by the U.S. Department of State.
10. Jia Guide and Shi Wuhong, "On China's Participation in Arctic Governance under New Circumstance," *Global Review* (Guoji Zhanwang, CN31-1041/D, July/August 2014): 27.
11. Robert W. Corell, "U.S. Chairmanship of the Arctic Council"—summary created from materials provided by the U.S. Department of State.

12. Yang Jian et al., *New Perspectives on the Arctic Governance*, Beijing: Current Affairs Publishing House (Shishi Chubanshe), 2014: 299.
13. Robert W. Corell, "U.S. Chairmanship of the Arctic Council"—summary created from materials provided by the U.S. Department of State.

Commentary

Oran R. Young[1]

The United States has announced an ambitious program for its two-year term as chair of the Arctic Council, which began at the ministerial meeting in April 2015 marking the close of Canada's chairmanship and will run until Finland assumes the chair at the next ministerial meeting in the spring of 2017.[2] Most of those who have commented on this program have focused on what the United States describes as "thematic pillars," including the impacts of climate change, stewardship of the Arctic Ocean, and economic and living conditions in the Arctic.[3] These are the substantive issue areas the United States intends to prioritize during its turn as chair of the council.

An equally important, though less often analyzed, component of the US program deals with what the program describes as other thematic areas or "overarching goals." Including the need to "continue strengthening the Council as an intergovernmental forum," to "introduce long-term priorities into the Council," and to "raise Arctic and climate change awareness within the United States and across the world," these goals direct attention to the nature of the Arctic Council as an intergovernmental body together with the character of its role in the international relations of the Arctic. Handled properly, the pursuit of these goals could produce results that outlive the consequences flowing from a focus on specific substantive issues or thematic pillars. For this reason, I will concentrate in this commentary on matters pertaining to the fulfillment of the overarching goals articulated in the American program. My objective is to say something not only about the significance of each of the goals but also about what may be needed to make progress toward fulfilling them. I will close with some general thoughts that grow out of this analysis regarding the performance of the Arctic Council to date and its place in the international relations of the Arctic going forward.

GOAL 1: CONTINUE STRENGTHENING THE COUNCIL AS AN INTERGOVERNMENTAL FORUM

The Arctic Council's role is fundamentally generative rather than regulatory. The council has neither the authority to adopt rules applicable to the activities of state and non-state actors in the Arctic nor the capacity to promulgate regulations, take the steps needed to administer such regulations, or ensure compliance with them on the part of those who are subject to the regulations. There is little prospect that the council will develop into a more formal intergovernmental organization able to play such a regulatory role during the foreseeable future.

On the other hand, the council has had remarkable success in playing a generative role, identifying emerging issues in a timely manner, framing them for consideration in policy debates, and moving them toward the head of the queue in relevant policymaking venues.[4] It is important not only to recognize the significance of this generative role but also to avoid taking steps that could erode the performance of the council in these terms, without materially strengthening the ability of the council to achieve success as a rule-making body. In my judgment, this is the danger lurking in the proposals of those who seek to turn the council into a "normal" intergovernmental organization whose authority is rooted in a legally binding instrument (e.g., an Arctic treaty) that calls for the council to engage in regulatory activities and anticipates the launching of a suite of programmatic activities through agreement on an indicative budget of the sort familiar from the operations of United Nations bodies. To its credit, the US chairmanship program is clear on this point.

This does not rule out a variety of more modest steps that would strengthen the council without seeking to turn it into a normal intergovernmental organization. These include measures to minimize the impression that the council operates as an exclusive club serving and defending the interests of a limited group of Arctic states, to ensure that the permanent participants have access to the resources needed to participate vigorously in the full range of council activities, and to develop more constructive relations with the non-Arctic-state and non-state actor observers.

Given the dynamism of the Arctic region and the shifting nature of relations between the Arctic and the wider world, moreover, it is essential to maintain the ability of the council to operate nimbly in adjusting its substantive activities and its operating procedures to changes in the needs for governance in the Arctic itself and in relations between the Arctic and the outside world.[5] This is one major reason to avoid investing a great deal of time and energy in the development of an Arctic treaty, an initiative that would require coming to terms with extremely difficult issues relating to participation and that would, at best, produce a relatively shallow agreement that might not enter into force for years. An Arctic treaty, like all other legally binding international agreements, would almost certainly be difficult to adjust smoothly and in a timely manner.[6]

Several organizational issues that would benefit from attention at this stage come into focus given this understanding of the council's role. To begin with, there is a mismatch arising from the Ottawa Declaration's call for the establishment of a "Sustainable Development Programme" to complement the "Environmental Protection Programme" inherited from the Arctic Environmental Protection Strategy.[7] The ordinary understanding of sustainable development emphasizes pursuing and balancing the three pillars of environmental protection, economic development, and sociocultural well-being.[8] Thus, environmental protection ought to be a component of the "Sustainable Development Programme" rather than a separate program operating on a par with the "Sustainable Development Programme." This does not mean that we should scale back efforts to address environmental concerns in the Arctic. But it does suggest that there is a need to deal with environmental issues in a manner that is sensitive to equally important concerns regarding the economic health of Arctic communities and the sociocultural well-being of Arctic residents.[9]

Another organizational issue centers on the proper division of labor between the council's working groups and the task forces that have been established in recent years to address a variety of more specific matters. The working groups (e.g., the Arctic Monitoring and Assessment Programme and the working group on the Protection of the Arctic Marine Environment) have performed well as the principal engines of the council's success in playing a generative role. The task forces (e.g., the Task Force on Black Carbon and Methane and the Task Force on Arctic Marine Cooperation) often seem to address topics that overlap the remit of the working groups; their efforts may well detract from the performance of the groups as generative engines. This is not to say that there is no role for task forces that may be established from time to time to spearhead efforts to negotiate the terms of specific intergovernmental agreements (e.g., the

American suggestion regarding the development of some sort of "Regional Seas" arrangement for the Arctic). But there is a need to clarify the division of labor between the working groups and the task forces and to administer the task forces in a manner that does not undermine the effectiveness of the working groups as generative mechanisms.

A third organizational issue concerns the Arctic Economic Council (AEC), launched during 2014 as the centerpiece of the Canadian chairmanship program. There are significant questions about both the structure and the functions of this body. If the intent is to provide a means for the Arctic Council to obtain timely input from major societal sectors, what is the justification for privileging the role of the business sector in contrast to major groups in civil society concerned with matters of health, education, and welfare or with issues of environmental quality? Should the AEC be treated as an arm of the Arctic Council itself or as an entity recognized as an independent body that is able to provide high-level input into the deliberations of the Arctic Council's working groups and task forces? Is there any reason to limit participation in the AEC to corporations or businesses that are based in the Arctic, an arrangement that would sideline important players (e.g., major oil companies) whose activities have far-reaching impacts on the Arctic though they are not based in the Arctic? The creation of the AEC is an important step. But at this stage, there is a need to resolve several fundamental issues regarding the nature of this body.

GOAL 2: INTRODUCE LONG-TERM PRIORITIES INTO THE COUNCIL

Actually, the long-term priorities of the council are relatively clear and straightforward, though there are many choices to be made regarding the best way to operationalize these priorities at any given time. Programmatically, the principal objective of the council is to promote sustainable development in the Arctic during a period of rapid biophysical and socioeconomic change. Politically, the council is dedicated to promoting international cooperation in the region, a matter of particular concern given the rising tensions between Russia and the West regarding a variety of matters focused outside the Arctic.

The council's remit as spelled out in the 1996 Ottawa Declaration on the Establishment of the Arctic Council is to pursue sustainable development, including but not limited to environmental protection, in the Arctic. Conversely, the declaration makes it clear that the council is not intended to become a mechanism for dealing with matters of military security in the ordinary sense of the term. Of course, sustainable development is a broad concept that is not easy to operationalize in concrete situations. This is particularly true under highly dynamic conditions like those prevailing in the Arctic today. Still, there is a good deal of experience both in the Arctic and elsewhere that those responsible for council activities can draw on in fleshing out this mandate. Above all, sustainable development requires a continuous commitment to blending and balancing environmental, economic, and sociocultural concerns. The concept of stewardship may well offer useful guidance in thinking about sustainable development in the Arctic, especially in managing the human-dominated systems that have emerged as the defining feature of the Anthropocene.[10]

A second long-term priority for the Arctic Council is to focus on maintaining cooperation between the Western members of the Arctic Council, which constitute a majority of the membership, and Russia, which encompasses almost half of the region and is in many respects the preeminent Arctic player. This role has become increasingly important with the growth of tension between Russia and the West arising from non-Arctic matters, such as the ongoing controversy over the future of the Ukraine and the civil war in Syria. The challenge today is to find ways to maintain cooperative relations regarding substantive issues in areas such as the Arctic, avoiding spillover from non-Arctic issues without denying or ignoring the reality of conflict regarding these issues. Given its track record in promoting a spirit of East-West cooperation, the Arctic Council may well be in a position to play a role in this realm whose significance extends beyond concerns specific to the Arctic.

Another factor worthy of consideration in thinking about the long-term priorities of the Arctic Council arises from the fact that the council is not the only game in town when it comes to addressing needs for governance in the Arctic.[11] The International Maritime Organization (IMO) is a major player with regard to commercial shipping; the United Nations Framework Convention on Climate Change (UNFCCC) is the key international venue for addressing matters relating to climate change; the regime established under the Stockholm Convention is the principal mechanism dealing with persistent organic pollutants; the five coastal states have taken the lead regarding potential fisheries in the Arctic Ocean, and so forth. This need not result in any conflict regarding the proper role of the Arctic Council. But it does have substantial implications for the proper division of labor between the council and these issue-specific regimes. The IMO, for example, has the regulatory authority to engage in rule-making activities of the sort exemplified by the new International Code for Ships Operating in Polar Waters (Polar Code) covering commercial navigation in polar waters.[12] But the council is in a position to gather information about key issues relating to navigation and to make assessments regarding the likely trajectory over time of commercial shipping in the Arctic that can prove extremely helpful in connection with efforts to implement the provisions of the Polar Code as well as to monitor compliance with its major provisions. In the case of climate change, to take another example, international regulatory measures must be negotiated under the auspices of the UNFCCC. But, as the impact of the Arctic Climate Impact Assessment report (sponsored jointly by the council and the International Arctic Science Committee) demonstrates, the work of the council can play an important role in documenting the actual effects of climate change regarding an array of matters including the recession and thinning of sea ice, the melting of permafrost, coastal erosion, the degradation of habitat for wildlife, and so forth in a manner that provides graphic evidence of the significance of climate change.[13]

At the same time, the case of climate change also provides evidence regarding the boundaries of the council's role. Taking note of the importance of short-lived climate pollutants as drivers of climate change, the council created the Task Force on Black Carbon and Methane and provided this task force with a mandate to come up with plans for reducing these pollutants. But most of the sources of black carbon and methane lie outside the Arctic and, in many cases, well beyond the jurisdiction of the Arctic states. The council has no authority to make decisions on its own regarding such matters. Under the circumstances, as the Arctic Climate Impact Assessment report makes clear, the council can play a generative role in providing evidence regarding the importance of these pollutants and exploring innovative ways to frame this issue for consideration by policymakers. But it cannot take decisions regarding what to do about the issue, a fact that raises interesting questions about the role of task forces in contrast to working groups in pursuing matters of interest to the council.

GOAL 3: RAISE ARCTIC AND CLIMATE CHANGE AWARENESS WITHIN THE UNITED STATES AND ACROSS THE WORLD

Unlike the first two goals, which address matters relating to the structure and functions of the council, the third overarching goal draws attention to a matter of profound importance that is more substantive in nature. The pertinent question here is: what is it realistic to expect the Arctic Council to do in raising climate change awareness, especially among those located outside the Arctic? Does it have a comparative advantage regarding some aspects of this matter? Are there steps beyond what it is already doing that could help to fulfill this goal? In my view, two responses to these questions are worth differentiating in thinking about this issue: one relating to the drivers of awareness and a second relating to what is known in discussions of climate change as adaptation in contrast to mitigation.

Much of the work of the Intergovernmental Panel on Climate Change and other scientific bodies has focused on systemic concerns and made use of modeling (e.g., the creation and operation of general circulation models or GCMs) to enhance understanding of the complexities of the Earth's climate system. This has yielded results that are impressive, especially to those who are scientifically literate.[14] But for the broader public, awareness is likely to be driven more by graphic evidence of the observable impacts of climate change than by reports on the results produced by runs of GCMs. Because climate change is progressing much more rapidly in the Arctic than in other parts of the planet, there is an unusual opportunity to make use of evidence based on actual observations of what is happening in the Arctic to enhance broader public awareness of the effects of climate change.[15] Dramatic images of storm surges eroding the foundations of coastal villages, melting permafrost wrecking havoc with the built environment, receding sea ice producing open water in the high Arctic, and melt water on the Greenland ice sheet lubricating surges of outlet glaciers do make a difference in crystallizing the somewhat nebulous concept of climate change in the public mind and bringing home to ordinary people the realities of the impacts of climate change on human welfare as well as on large biophysical systems. The Arctic Council has already played a substantial role in enhancing awareness through efforts such as those reflected in the 2004 Arctic Climate Impact Assessment report and the 2011 assessment on Snow, Water, Ice and Permafrost in the Arctic.[16] The council is well-placed to continue making significant contributions of this sort.

At the same time, it is inappropriate for any of those dealing with climate change and especially participants in the work of the Arctic Council, which has a mandate to foster the well-being of the Arctic's human residents, to treat the region simply as the canary in the coal mine when it comes to issues relating to climate change. Human communities in the Arctic are at risk now as a consequence of the onset of climate change for reasons ranging from coastal erosion attributable to storm surges unleashed by the recession of sea ice to the effects of oil spills arising from energy development made possible by the increased accessibility of Arctic oil reserves. Under the circumstances, the council must direct its attention not only to raising climate change awareness on the part of the general public but also to focusing on matters of adaptation to the impacts of climate change on the part of the region's human population. This is easier said than done. The challenges of adaptation differ from country to country and even from one community to another within the same country. There are important differences in perspective among communities and even among the members of the same community in this realm. The residents of most Arctic communities are not uniformly opposed to oil and gas development in adjacent areas, for example, despite the fact that development of this sort only adds to emissions of greenhouse gases that are the drivers of climate change.[17]

Well-intentioned outsiders who approach communities with initiatives designed to promote adaptation generally get nowhere unless they are prepared to work with members of the communities and accord them central roles in the resultant projects. The Arctic Council has neither the authority nor the resources needed to take the lead in mounting and monitoring substantive adaptation measures within individual Arctic states. Yet, it is essential for the council not to throw up its hands regarding this matter, declaring that adaptation is a subject to be tackled by national and subnational authorities rather than by an intergovernmental forum. Dealing with the issue of adaptation could well become a top priority of the Sustainable Development Working Group. Concrete steps could include promoting efforts of communities across the region to compare notes regarding the effectiveness of specific adaptation strategies, encouraging innovative thinking about new approaches to adaptation, and developing a catalogue of best practices based on the actual experience of Arctic communities.

CONCLUDING THOUGHTS

The Arctic Council has proven more effective than any of us who participated in the process of launching the council during the 1990s anticipated. Despite its limitations with regard both to the legal authority needed to engage in rule-making endeavors and to the material resources needed to launch major programmatic activities, the council has played an important role in terms of what I call its generative function. There is every reason to expect that the council can continue to perform well in these terms, despite the transformative changes that have been unfolding in the Arctic in recent years. But these changes put a premium on the ability to identify emerging issues in a timely manner and to frame them in ways that make them tractable in policy processes. There are various adjustments that would enhance the council's effectiveness in these terms and that ought to be politically feasible. A particularly positive development in this regard centers on the establishment in Tromsø, Norway of a modest permanent secretariat for the council that has demonstrated an ability to handle the day-to-day affairs of the council in a professional and effective manner. But it is critical to remain clear on the essential nature of the council and its role in Arctic affairs and to avoid promoting changes aimed at expanding the role of the council that would be unlikely to succeed in their own terms and that could easily undermine the efficacy of the council in the performance of its generative role.

There is a natural tendency among both policymakers and civil servants to push an informal body like the Arctic Council toward becoming what I have characterized as a normal intergovernmental organization. In some situations, progressive development of this sort may be beneficial. But this is not always the case. The important point, as students of governance have emphasized, is to achieve a good fit or match between the nature of the functions to be performed and the attributes of the institutional arrangements created to perform them.[18] In the case of the Arctic Council, in my judgment, there are compelling reasons to maintain and even strengthen the capacity of the council to play its generative role effectively and to ensure that it has the ability to adapt nimbly to emerging needs for governance in a region experiencing transformative change both internally and in its relations with the wider world. The United States would be wise to ground its work as chair of the Arctic Council during 2015–17 on this proposition, whatever initiatives it chooses to launch under the rubric of "thematic pillars.

Notes

1. I am indebted to Alf Håkon Hoel for helpful comments on an earlier draft of this essay.
2. U.S. Department of State, "One Arctic—Shared Opportunities, Challenges and Responsibilities" (2015), URL: www.state.gov/e/oes/ocns/opa/arc/uschair/index.htm.
3. There are slight variations in wording in different statements setting forth the U.S. chairmanship program. In this essay, I follow the wording set forth in the presentation of Julie Gourley, the US Senior Arctic Official, at the 2015 North Pacific Arctic Conference, 6 August 2015.
4. Oran R. Young, *Governance in World Affairs* (Ithaca: Cornell University Press, 1999): ch. 2.
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11. Oran R. Young, "Building a Regime Complex for the Arctic: Current Status and Next Steps," *The Polar Journal* 2 (2012): 391–407.
12. IMO, "Shipping in Polar Waters" (2015), URL: www.imo.org.
13. ACIA, *Impacts of a Warming Arctic* (Cambridge, UK: Cambridge University Press, 2004).
14. IPCC, *Fifth Assessment Report* (AR5, 2013–14), URL: https://www.ipcc.ch/report/ar5/.

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16. ACIA, *Impacts* . . . ; AMAP, *Snow, Water, Ice and Permafrost in the Arctic*. (Oslo: AMAP, 2011).
17. Alaska’s North Slope Borough, for example, depends on income derived from taxes on oil infrastructure as its principal revenue source. There is a vigorous debate in Greenland about the prospect that energy development or mining could provide the financial wherewithal needed to increase Greenland’s independence from Denmark.
18. Victor Galaz et al., “The Problem of Fit among Biophysical Systems, Environmental and Resource Regimes, and Broader Governance Systems,” in *Institutions and Environmental Change*, edited by O. R. Young, L. King, and H. Schroeder (Cambridge: MIT Press, 2008), 147–86.

Commentary

Akiko Okamatsu

INTRODUCTION

It has been years since the effects of global warming in the Arctic first indicated that global warming is leading to a shrinkage of Arctic sea ice.[1] This ice shrinkage may generate new problems, such as how to deal with the creation of new waterways through the Arctic, called the Northwest Passage, and the exploitation of natural resources.

On 24 April 2015, the United States published its U.S. Arctic Council Chairmanship program entitled "One Arctic: Shared Opportunities, Challenges and Responsibilities." It mentions (1) "Improving Economic and Living Conditions in Arctic Communities"; (2) "Arctic Ocean Safety, Security and Stewardship"; and (3) "Addressing the Impact of Climate Change" on a global scale.

Japan has long been concerned with the Arctic and the Japanese government has addressed the importance of joining the discussion forum for the Arctic Ocean and expressed a desire to contribute actively to both scientific research and international cooperation. The Japanese government also appointed a "Special Representative for the Arctic Region" in 2013 to contribute to this area.

JAPANESE PRACTICE IN THE ARCTIC

Since Japan is a maritime state, Japanese efforts in researching the Arctic have a long history. According to the Japanese government, it has two major challenges ahead.[2] One is to grasp what is going on in the Arctic and the impact of Arctic changes on the global environment based upon scientific research. The Japanese government hopes to predict further changes precisely and take necessary measures to tackle any negative impacts. Second is to establish common understanding among the countries regarding economic uses appropriate for the Arctic. For these purposes, it is believed that the following practices will play an important role.

Observations and Research in the Arctic

The Ministry of Education, Culture, Sports, Science and Technology (MEXT) started the Green Network of Excellence (GRENE) Arctic Climate Change Research Project "Rapid Change of the Arctic Climate System and its Global Influences" planning for 2011–16.[3] The project has four strategic research targets: (1) understanding the mechanisms of warming amplification in the Arctic, (2) understanding the impact of global climate and future change on the Arctic system, (3) evaluating the impact of Arctic changes in weather and climate on Japanese marine ecosystems and fisheries, and (4) projecting sea ice distribution and Arctic sea routes. This project is followed by the Arctic Challenge for Sustainability (ArCS) project. ArCS aims to contribute to decision-making and problem-solving processes; lead international cooperation; build a system for international communication with other stakeholders; promote interdisciplinary research, and transmit information.

MEXT recognizes that the strengths of Japanese research are its wide spectrum of research activities and its advanced satellite, ocean monitoring, and simulation technologies. Therefore, the Japanese government aims to strengthen bilateral and multilateral research cooperation in order to contribute to international interactions with other stakeholders and develop adaptation and mitigation measures for non-Arctic areas. MEXT also tries to contribute to development of cutting-edge observation technology development.

The National Institute of Polar Research (NIPR) started polar research on both the Antarctic and the Arctic in 1963. As the importance of Arctic research increased, it established the Arctic Environment Research Center (AERC) in June 1990 to promote sea ice study, oceanography, marine ecology, terrestrial ecology, atmospheric science, glaciology, and upper atmospheric science.[4] NIPR recognized the Arctic as a key region for global climate and environment and pursues on-site observations of air quality, snow and ice, oceans, the terrestrial environment, and the upper atmosphere in order to shed light on the mechanisms of climate and environmental changes and their impact on ecosystems.[5] NIPR also established an observation site in Svalbard in Norway to observe glaciers, the terrestrial ecosystem, and air in 1991.[6]

The Japan Agency for Marine-Earth Science and Technology

(JAMSTEC) also works actively in this area focusing on assessment of the impact of sea ice reduction on heat/fresh water transport and the sea ice processes. Its Arctic Ocean Climate System Research program has investigated the Arctic using the observation ship *Mirai*[7] since 1998 and aims both to understand how and why rapid sea ice reduction in the Arctic Ocean affects the Arctic environment and the global climate system and to assess their impacts on the climate of Japan and the mid-latitudes of the Northern Hemisphere.[8]

The Japan Aerospace Exploration Agency (JAXA) plays a leading role in research that uses observation satellites. *Ibuki*, the Greenhouse Gases Observing Satellite (GOSAT), developed jointly by the Ministry of the Environment (MOE) and the National Institute for Environmental Studies (NIES), is the only satellite in the world designed specifically to monitor greenhouse gases from space. The satellite's main mission is to monitor atmospheric carbon dioxide (CO_2) and methane concentrations from space to improve the accuracy of sink/source estimates not only for the Arctic environment but also for the entire world.[9] JAXA's "Global Change Observation Mission" (GCOM) has two series of satellites: GCOM-W for observing water circulation changes and GCOM-C for climate changes. The GCOM-W satellite called *Shizuku* has a microwave radiometer onboard that observes precipitation, vapor amounts, wind velocity above the ocean, seawater temperature, water levels on land areas, and snow depths.[10] These data are used to monitor the Arctic and related environments. JAXA also participates in the International Arctic Research Center (IARC) at the University of Alaska (Fairbanks) that was established as a cooperative research institute supported by both the United States and Japanese governments for the study of climate change in the Arctic regions.[11]

Research for Navigation

Until 2009, the ice prevented regular marine shipping in the Arctic throughout most of the year. But climate change has reduced the packed ice, and this shrinkage has made waterways, such as the Northwest Passage and the Northern Sea Route, more navigable without icebreaker escorts. If ships can use this passage regularly, the transportation distance between Asia and Europe will be reduced significantly, reducing both fuel requirements and shipping times as well.

Japanese research on the possibility of commercial uses of these routes is trailblazing. Japan is a maritime state surrounded by oceans. Therefore, it depends on maritime transportation for 99 percent of its shipping needs. In response to the observation that Japan would have a huge interest if these routes became navigable, the International Northern sea Route Project (INSROP) was carried out during 1993-1999 as a collaboration among the Fridtjof Nansen Institute in Norway, Central Marine Research and Design Institute in Russia, and the Ocean Policy Research Foundation(OPRF) in Japan.[12] Parallel with INSROP, a domestic project, the "Japan Northern Sea Route Programme (JANSROP)," was implemented by OPRF. This project entered a new phase in 2002(JANSRP Phase II), adding Canada and other countries and lasting for three years.[13] These comprehensive research projects are highly regarded in international forums such as the Arctic Council.[14]

Contributions to the U.S. Chairmanship of the Arctic Council

Although Japan is not an Arctic coastal state, it has participated in discussions about the Arctic at related international institutions and fora. As Japan has become an observer of the Arctic Council, it will faithfully support the U.S. Chairmanship and follow the discussion there. Scientific knowledge is definitely required for management of the Arctic, and it is believed that Japan may contribute to the international decision-making process through its scientific contributions.

CONCLUSION

Although Japan is not an Arctic coastal state, it is nevertheless a stakeholder regarding Arctic issues. Japan has the highly advanced technology necessary for research into the Arctic and promotes various projects under the leadership of the Japanese government. The data and scientific knowledge resulting from Japanese research will be shared in international forums and contribute to the protection of the Arctic environment and effective use of the Arctic.

Notes

1. The latest data on Arctic Sea Ice Extent by Japan Aerospace Exploration Agency (JAXA) is on the website: http://www.eorc.jaxa.jp/imgdata/topics/2014/img/tp140929_02.png; http://www.eorc.jaxa.jp/imgdata/topics/2014/bn1407_09.html (accessed 30 September 2015).
2. See the speech by the parliamentary vice-minister for foreign affairs of Japan at Arctic Science Summit Week (ASSW) 2015. http://www.mofa.go.jp/mofaj/files/000078126.pdf (accessed 30 September 2015).
3. http://www.nipr.ac.jp/grene/e/index.html (accessed 30 September 2015).
4. Arctic Environment Research Center's website is http://www.nipr.ac.jp/aerc/e/about.html (accessed 30 September 2015).
5. http://www.nipr.ac.jp/aerc/e/research/index.html (accessed 30 September 2015).
6. Japan is one of the original members of the Svalbard Treaty of 1920 which stipulates that all signatory countries were granted non-discriminatory rights to fishing, hunting, and mineral resources in Svalbard.
7. *Mirai* provides excellent navigational performance and resistance to ice. The vessel can conduct long-term observational studies over wide areas and is used for oceanographic surveys primarily in the subtropic and subarctic regions of the Arctic and other oceans. *Mirai* is expected to perform a role as a base for transmitting various types of marine and Earth data and as an advanced international station for ocean-based, marine-Earth research. http://www.jamstec.go.jp/e/about/equipment/ships/mirai.html (accessed 30 September 2015).
8. See: http://www.jamstec.go.jp/rcgc/e/aocsrg/ (accessed 30 September 2015).
9. http://global.jaxa.jp/projects/sat/gosat/topics.html#topics3579 (accessed 30 September 2015).
10. http://global.jaxa.jp/activity/pr/brochure/files/sat25.pdf (accessed 30 September 2015).
11. http://www.iarc.uaf.edu/ (accessed 30 September 2015).
12. https://www.sof.or.jp/en/activities/index6.php(accessed 9 March 2016).
13. For more details, see: https://www.sof.or.jp/en/activities/index6_2.php (accessed 9 March 2016).
14. Arctic Council, *Arctic Marine Shipping Assessment Report* 2009, 49, 115. http://www.pame.is/images/03_Projects/AMSA/AMSA_2009_report/AMSA_2009_Report_2nd_print.pdf (accessed 30 September 2015).

PART II

CLIMATE CHANGE: POLICY IMPLICATIONS FOR THE NATIONS WITH ARCTIC INTERESTS

3. Climate Change: Mitigating Arctic Impacts and Adapting to Changed Conditions

Thomas R. Armstrong

INTRODUCTION

The Arctic is a rapidly changing socioecological system in which both change and the rate of change are significantly increasing. It is one of the few systems on the planet where the impacts and effects of human-induced climate change can be observed readily today. These changes have recently been well summarized with the release of National Oceanic and Atmospheric Administration (NOAA)'s 2014 *Arctic Report Card* (an annual summary of climate change and related impacts within the Arctic region):

> *In 2014, we continued to see the impacts of a persistent warming trend that began over thirty years ago and which overlies significant year-to-year and regional variations. Central to the story are Arctic air temperatures, which continue to increase at a rate of warming that is more than twice as fast as at lower latitudes. This well-documented effect is called 'Arctic Amplification' of global warming. In early 2014, the warming Arctic atmosphere was strongly connected to lower latitudes as the polar vortex weakened and the waves in the jet stream became more pronounced. Consequently, cold air moved southward into eastern North America and central Russia, while warm air flowed northward into Alaska and northern Europe. Alaska recorded temperature anomalies more than 10° Celsius (18° Fahrenheit) higher than the January average.*
>
> *Responding to the persistent warming air temperatures, snow cover extent across the Arctic during spring of 2014 was below the long-term average of 1981–2010. A new record low extent was set in April in Eurasia, and North America's June snow extent was the third lowest on record. Snow disappeared three to four weeks earlier than normal in western Russia, Scandinavia, the Canadian sub-Arctic and western Alaska due to below average accumulation in winter and above normal spring temperatures.*
>
> *The extent of sea ice in September 2014 was the sixth lowest since satellite observations began in 1979, and the eight lowest sea ice extents since satellite*

observations began in 1979 have occurred in the last eight years (2007–14). Interestingly, the rate of reduction in Northern Hemisphere snow cover extent in May and June now exceeds the rate of summer sea ice loss, and snow extent and sea ice extent have been highly correlated since the mid-1990s.

As sea ice retreats in summer, sea surface temperature in all the marginal seas of the Arctic Ocean is increasing. This trend is most apparent in the Chukchi Sea, northwest of Alaska, where sea surface temperature is increasing at a rate of 0.5°C per decade. In August 2014, in the Laptev Sea north of Russia, and in the Bering Strait region between Russia and Alaska, where sea ice retreated relatively early, sea surface temperature was as much as 4°C higher than the 1982–2010 average.

Larger regions of open water can also be linked to increases in production at the base of the food web, due to the increased amount of solar radiation available for photosynthesis, and the availability of nutrients. In June, July, and August 2014, the highest primary production values occurred in the Kara and Laptev seas north of Russia. The timing of phytoplankton blooms throughout the Arctic Ocean is also being affected by the loss of sea ice, with more frequent secondary blooms during the autumn.

There is growing evidence that polar bears are also being affected by changing sea ice cover. Indeed, in areas where we have long-term data, there are troubling signs for both polar bears and other animals that depend on the ice cover for survival. For example, between 1987 and 2011 in western Hudson Bay, Canada, a decline in polar bear numbers, from ~1,200 to ~800, can be linked to earlier sea ice break-up, later freeze-up and, thus, a shorter sea ice season. In the southern Beaufort Sea, where there are now twice as many ice-free days over the continental shelf as there are immediately to the west in the Chukchi Sea, adult polar bear numbers stabilized at ~900 by 2010 after a ~40 percent decline since 2001. The survival of young bears in the southern Beaufort Sea also declined between 2001 and 2010. In contrast, polar bear condition and reproductive rates in the Chukchi Sea may be stable at present—reflecting greater productivity of that system, fewer ice-free days over the continental shelf, and a possible rebound from significant harvest in the mid-90s.

On land, there is additional evidence of the impact of the persistent warming trend. Peak tundra greenness, a measure of vegetation productivity and biomass, continues to increase. Between 1982 and 2013, the tundra biomass increased by 20 percent.

On the Greenland ice sheet, melting occurred across almost 40 percent of *the surface in summer 2014, and for 90 percent of the summer, the extent of melting was above the long-term average for the period 1981–2010. Also, the number of days of melting in June and July exceeded the 1981–2010 average over most of the ice sheet. In August 2014, the reflectivity (albedo) of the ice sheet, which affects the surface energy balance and melting, was the lowest observed since satellite observations began in 2000.*

The Arctic is not without its mixed signals, however, due largely to the effects of year-to-year and regional variations. For instance, at the time of maximum sea ice extent in March 2014, there was evidence of a modest increase in the age of the ice and its thickness relative to March 2013. On land, where tundra peak greenness continues to increase, tundra greenness integrated over the entire summer has been decreasing in Eurasia—a so-called 'browning trend' and shortening of the growing season—since 1999, where summer air temperatures happen to have been decreasing. Perhaps most surprising was that the total mass of the Greenland ice sheet remained essentially unchanged between 2013 and 2014.

The impacts of the persistent warming trend of over thirty years remain clearly evident in the land and ocean environments, and these impacts are influencing the Arctic marine and terrestrial ecosystems. Given consistent projections of continued warming temperatures, we can expect to see continued widespread and sustained change throughout the Arctic environmental system.

But we won't see those changes if we don't at least maintain and sustain our current long-term observing capabilities. Indeed, if we're to understand how this complex environmental system works, improve predictions of what is likely to happen in the future, and identify appropriate responses to the anticipated changes, we need to add to our observing capabilities. Observations are fundamental to Arctic environmental awareness, government and private sector operations, scientific research, and science-informed decision-making as required, for example, by the US National Strategy for the Arctic Region.

Clearly, change is occurring within the Arctic. The focus now must shift to identifying and developing an integrated strategy for long-term mitigation of carbon pollution to the atmosphere (thereby ameliorating human-induced climate change) while in the short-term developing effective strategies for preparing for and adapting to the inevitable impacts and effects that are consequences of our heretofore absent strategy for addressing the climate change problem effectively. The strategies for dealing with mitigation of carbon pollution are tied to both national and international legislation, executive orders, and multilateral agreements (most likely of a legally binding nature). Development and - maybe most important—the acceptance of effective carbon reduction policies, agreements and legislation must begin with a clear and accurate understanding of the drivers of carbon pollution as well as the related climate impacts and effects. The major impacts and effects that are and will continue to be felt across the Arctic (as well as those originating within the Arctic that impact the rest of the global community) are the subject of the next section of this paper.

It is in the area of adaptation where a wide array of potential actions is possible, at all scales and at all levels of decision-making. Thus, the focus of this paper will be on identifying the major climate-related impacts and effects either generated within or impacting the Arctic and the discussion of how best to approach strategically sound and cost-effective adaptation actions that can prevent wholesale system failure.

The following sections will describe the major Arctic climate change impacts and effects that are being recognized and predicted throughout the Arctic. While certainly not an exhaustive set of issues, these are the predominant issues that keep coming up in the many stakeholder engagements that occur on a range of scales throughout the Arctic (and throughout the global community as well), from the local indigenous peoples' communities all the way up to the forum that includes both national and international political leaders. Following these sections, we will investigate how one develops strategies to deal with the plethora of stakeholder requests for taking local to global actions to adapt to a changing Arctic

MAJOR ARCTIC CLIMATE IMPACTS AND MITIGATING ACTIONS

Sea Level Rise

Due to accelerated loss of terrestrial ice in both the Northern and Southern Hemispheres, it is clear from both national climate assessments (e.g., the

2014 US National Climate Assessment) and international assessments (e.g., the Intergovernmental Panel on Climate Change (IPCC) *Fifth Assessment Report* [AR5]) that previous estimates of sea level rise have been significantly biased toward minimum estimates or even underestimates of what is now considered to be the most accurate scientific estimates. Figure II.1 is derived from a compilation of several new studies, including the 2014 US National Climate Assessment and the most recent IPCC report (AR5).

While there are many implications related to this information, the most salient conclusions are that there is going to be a significant increase in total sea level rise and that the rate of sea level rise worldwide (related directly to accelerated loss of terrestrial ice in both hemispheres) will continue to increase such that coastal communities can expect about one foot of rise every twenty to twenty-five years. In fact, the IPCC estimates that somewhere between 150 million and 400 million people in vulnerable coastal communities will be impacted by sea level rise by the year 2100 (IPCC, AR5).

In the case of sea level rise, the Arctic is both a driver and a victim of change. A significant amount of the remaining terrestrial ice mass is located in Greenland. Continued melting of ice mass will provide a significant contribution to the predictions illustrated in the figure below. On the other hand, any and all sea level rise related to terrestrial ice loss

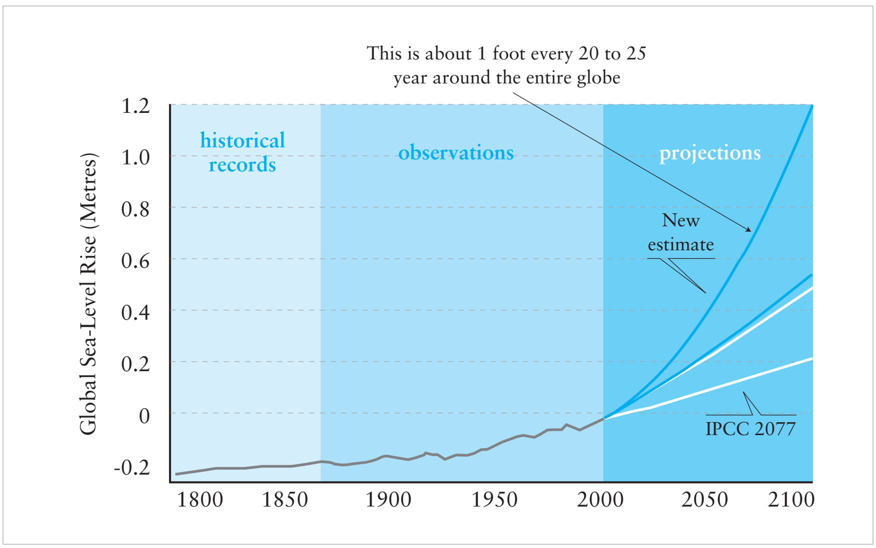


Figure II.1 Global Sea Level Rise

in either hemisphere will contribute to the overall sea level rise budget and produce very Arctic-specific impacts as well, especially increased coastal erosion along the Arctic Ocean shoreline. This increased erosion will have serious impacts on indigenous peoples' communities and other coastal communities currently situated in erosion-vulnerable locations. Similarly, Arctic oil and gas exploration and production facilities located within the coastal zone may also be vulnerable to accelerated sea level rise, requiring substantial fiscal and human resource investments in order to harden infrastructure and prepare it for both short- and long-term sustainability in this constantly changing environment. Other forms of infrastructure may also be impacted in similar ways.

Sea Ice Loss: Opening of the Arctic Seaway

While there are many different aspects of change related to the Arctic Ocean, the most immediate and obvious change is the change in extent of summer sea ice. Whereas many other indictors of climate change must currently rely on subtle differences in past and current observations, the annual- and decadal-scale changes in observed Arctic Ocean summer sea ice extent are significant and obvious. Figure II.2 shows the past and current observations of Arctic Ocean summer sea ice extent for the period 1870 to

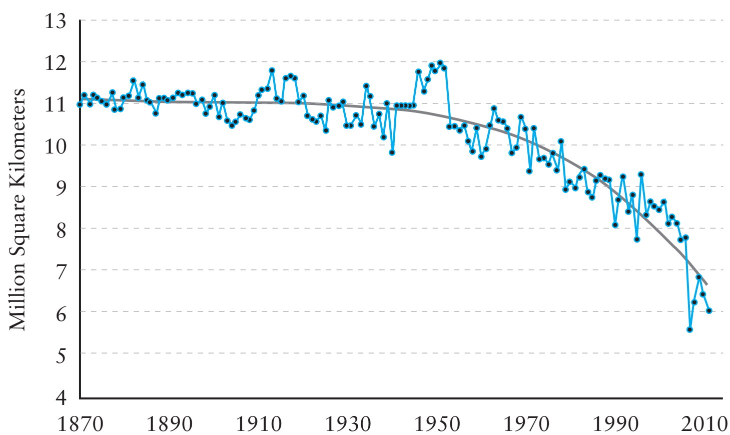


Figure II.2 Summer Arctic Sea Ice Extent: July–September, 1870–2008

2011. Notice that the trend line shows relatively no change in summer sea ice extent from 1870 to a time around 1950. Beginning around 1950, the trend line begins to display a progressive decline in summer sea ice extent such that each decade shows an approximately 10 percent decline in the summer sea ice extent relative to the previous decade.

In addition, the actual observed sea-ice extent from 1979 to present shows much greater decline in overall sea ice extent than the model-projected sea ice extent for the same time period. Thus current and actual sea ice loss is occurring at a much greater rate than the climate models currently predict. This must be kept in mind since many of the current Arctic summer sea ice extent models predict a nearly ice-free Arctic Ocean (for summer sea ice extent) as early as 2040.

One can imagine that there are and will be many different impacts and consequences of continued summer sea ice loss. Three of the most significant ones are economic impacts on (1) global shipping, (2) oil and gas exploration and extraction, and (3) maritime security. Current estimates indicate that by 2040, the Arctic ocean shipping routes will be essentially ice-free during summer months, increasing the shipping transit season from less than one month at present to as much as three to six months. In addition, the predicted northern shipping routes that will permit Atlantic-Pacific Ocean transit may be as much as 45 percent shorter in distance as current transit routes that require passage via the Suez Canal.

Oil and gas fields within the Arctic Ocean slope and coastal regions, currently bound by summer sea ice may become more economically feasible in a summer sea-ice free Arctic Ocean. While many existing oil and gas fields in the coastal zones of the United States and Canada would potentially be enhanced, the opening of currently ice-bound fields already assessed within the coastal zone of northern Russia, the Finnmark coastal zone of the Barents Sea, and the identified fields along the northeast and northwest coasts of Greenland could provide new opportunities for fossil fuel energy development.

Many countries have already begun to predict an increase in marine traffic through an essentially ice-free Arctic Ocean of the near future. With an increase in commercial and tourist traffic, especially related initially to intra-Arctic Ocean shipping and port transit, comes an increase in concern for marine safety and security. Coupled with the previous discussion of increased economic opportunities through commercial shipping, oil and gas development, and the economic incentives provided through various aspects of Arctic tourism and related transit, issues such as geopolitical boundary agreements under the United Nations Convention on the Law of the Sea (UNCLOS) and sovereignty/national security concerns take on an ever-increasing level of importance—and tension—within an increasingly open Arctic Ocean.

Weather Extremes

Currently there is much debate within the scientific community regarding the role of climate change in generating or amplifying extreme weather events, such as strong cyclonic storms (hurricanes and tornadoes). But there is significant scientific evidence that climate change and climate variability play significant roles in causing and/or amplifying flood events and droughts across many regions of the world as well as in the amplification of high-heat events. In fact, whether or not these extreme events are triggered in part, or solely, by climate change is a secondary issue; these events are an important driver of socioeconomic and natural resources-related impacts throughout the Arctic. In addition, it is also evident that with respect to changes in weather patterns (and thus ultimately to extreme events themselves), the Arctic is a fundamental driver of significant changes within both the Arctic and beyond, well into other communities and ecosystems across the globe.

Some characteristic features of extreme events:

- Recent observations show more frequent extremes across the globe, with what were previously observed as 1 in 100 year events now appearing to be 1 in 20 year events or even more frequent. This is certainly the case with riverine flooding.
- Heat extremes will have a significant effect on agricultural regions. The impact of temperature extremes on crop production has been well documented with the likelihood of more hot days with record heat and precipitation changes making crop yields more vulnerable.
- Heat extremes will have an increasingly significant effect on human health. This is especially true of specific demographic populations including the old, the young and the poor.
- A warmer atmosphere is certainly predicted for the near future; this means more water vapor in the atmosphere, which will likely lead to an increase in the number of storms and possibly in their average

overall intensity.

The Arctic will also have a potentially profound influence on extreme events in other parts of the globe as well:

- Perturbations to the Arctic center of the Northern Hemisphere's jet stream (the "polar vortex") will continue to lead to amplifications in the "loops" associated with cold-air moving further south into the mid latitudes of North America and Europe. This will lead to increased colder temperature events especially during winters.
- Concomitant with the movement of polar cold air masses farther southward, we can expect the northward movement of hot and humid air from the mid latitudes, producing unseasonably warm temperature events in northern latitudes that may be of significant impact in both winter and summer seasons.
- Some scientific studies now indicate that changes in long-term weather patterns and even climate variability may increase as a result of human-induced climate change. This could have serious impacts on the duration, frequency and intensity of many of the extreme events mentioned above.

Many of the most commonly perceived extreme events bring justifiable attention to the impacts and effects of real-time disasters such as hurricanes and tornadoes. In fact, the NOAA now produces a report that is an annual update to the number of extreme events that generate disasters that produce more than One-Billion Dollars of damage. The number of these One-Billion Dollar events appears to be increasing at an alarming rate. Yet, even those events that create impacts and effects, such as long-term drought and multi-week long high-heat events, cause death and destruction that goes way beyond the statistics of the real-time events. Categorizing such long-term events with subtle beginnings and endings is a major challenge. Suffice to say that the impacts and effects of all types of extreme events is a much more serious issue than has been heretofore recognized; it is a major impetus in and of itself for communities to begin more proactive adaptation and resilience planning in order to be better prepared to face these impacts in the future and to ameliorate their serious economic and human costs.

Ocean Acidification

The ocean regulates our climate and our weather and plays a fundamental role in maintaining the Earth's water, carbon, and nutrient cycles. Since the start of the industrial revolution, human activities have upset the preexisting balance of nutrients in the ocean. Changes in the oceanic carbon cycle are among the most dramatic. The ocean has absorbed nearly one-third of the carbon dioxide (CO_2) added to the atmosphere by humans from deforestation and the burning of fossil fuels. Because the ocean has absorbed so much CO_2, greenhouse warming of the atmosphere is less severe. But there is a critical downside: the dissolved CO_2 increases the acidity of ocean water, threatening aquatic life and the livelihoods that depend on it. Without global action to limit CO_2 emissions, this trend will continue.

Ocean acidification is a big issue for the Arctic, where relatively shallow water depths and significantly large CO_2 influxes from both human and natural sources can result in acidic waters, leading to substantial impacts on a vulnerable food web. Exacerbating the problem is the fact that the relatively cold waters of the Arctic allow CO_2 to be absorbed more easily than in warmer tropical waters, amplifying the acidifying effect of atmospheric CO_2 at polar latitudes.

In addition, as ice melts in the Arctic, the seawater becomes less salty,

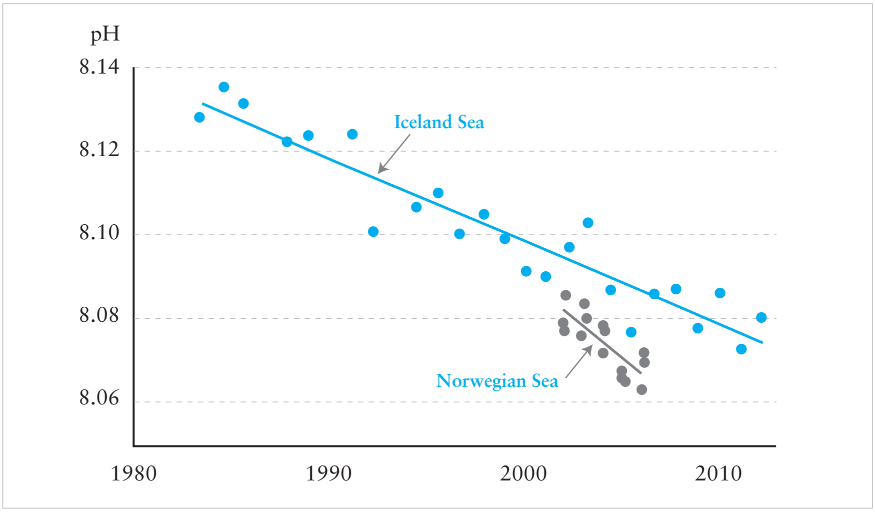


Figure II.3 Acidification of the Arctic Oceans and Seas and less salty water absorbs CO_2 more efficiently. Yet with all of these potentially significant impacts and related consequences, acidification of the Arctic Ocean is poorly understood, under-observed, and under-researched. Continued anthropogenic climate change and increasing amounts of carbon uptake by the Arctic ocean are likely to have significant detrimental impacts on the physical, biological, social and economic state of today's, and especially tomorrow's, Arctic communities (see Figure II.3; progressive decrease in pH with more freshwater influx into Norwegian sea causing increased rate of acidification).

The ocean is a major driver of our climate. The Gulf Stream transports warm, salty water from the Caribbean to the North Atlantic Ocean where it sinks and returns southward in the deep ocean. This ocean current warms the United States east coast and northern Europe. However, as ocean temperatures increase and polar ice disappears, the strength of this current is likely to decrease, with potentially significant consequences for large parts of the Atlantic basin and surrounding regions. The Intergovernmental Panel on Climate Change (IPCC) *Fifth Assessment Report* included several important findings with relevance to both global ocean health and acidification of the Arctic Ocean, including:

- Ocean warming dominates the increase in energy stored in the climate system, accounting for more than 90 percent of the energy accumulated between 1971 and 2010 (60 percent above 700m, 30 percent below 700m).
- Ocean acidity has increased approximately 30 percent since the Industrial Revolution.
- More acidic oceans will have broad and significant impacts on marine ecosystems, the services they provide, and the coastal economies that depend on them.
- Oceanic uptake of anthropogenic CO_2 will continue under all future emission scenarios. However, uptake is greater for higher concentration pathways causing even more acidification, with carbon cycle feedbacks that will exacerbate climate change.

Thawing Permafrost

The frozen ground of the Arctic is an important, yet poorly understood, element of the entire Arctic—and even the Global—climate system.

Millions of tons of organic carbon are locked within this frozen soil, serving as a vault that until now has prevented interaction of its stores with the atmosphere or hydrosphere. Furthermore, the frozen nature of much of the Arctic has made permafrost an important component of socioeconomic growth in this region as well as a steward of indigenous and local peoples' cultures and overall lifestyles. Some key aspects of the permafrost region of the Arctic:

- The hard and impenetrable forms of permafrost have served as a reliable foundation for highways and airstrips that promote transportation and communication across the region and to other parts of the globe.
- The frozen interstitial water between sand and silt grains has kept large parts of the Arctic tundra from eroding away under extreme conditions of storm and ocean wave activity.
- Long-standing indigenous and local communities have relied upon the permafrost to serve as their stable foundation, often providing insulation from temperature extremes on both ends of the spectrum.
- Carbon locked away in the permafrost is not able to interact with either the oceans or the atmosphere, thereby preventing increased acidification of the waters or increases in levels of atmospheric greenhouse gases that may lead to linear or even non-linear changes in the climate regime, including abrupt climate change events that may have global ramifications.

Yet, the permafrost regions of the Arctic—especially the discontinuous permafrost zones of the southern part of the Arctic Circle—are beginning to change at an alarming rate. Some of the key aspects of this change include:

- increased distribution of the discontinuous permafrost zone (areas where the permafrost is not at the surface of the soil profile or is not spatially contiguous at measurable depths) and the resultant decrease in continuous permafrost;
- increasing annual and maximum summer temperatures observed in boreholes throughout the discontinuous permafrost zone, with many boreholes having observed summer temperatures approaching the melting point of water;
- increasing methane and CO_2 emissions to the atmosphere in locales

where permafrost is actively thawing; and
- decreases in the flux of dissolved organic carbon during spring season melts within major rivers of the Arctic.

All the aspects of permafrost identified above strongly indicate that the permafrost region of the Arctic is thawing and that the liberated carbon is not simply passing out to sea. Rather, it is being transformed into gaseous phases (methane and CO_2) that are being liberated to the atmosphere. Although carbon flux monitoring stations are scant across the Arctic, local observations across Finland, Norway, Canada, the United States and Russia all point to a condition where, due to continued global warming, the discontinuous permafrost zone of the Arctic is increasing in size at the expense of the continuous permafrost zone. In addition, many parts of the discontinuous zone are now emitting methane and CO_2 to the atmosphere. With this in mind, as well as the even most conservative estimates of many gigatons currently frozen in this permafrost, there is growing concern that the continued thawing of Arctic permafrost may lead to a climate tipping point where increases in atmospheric carbon will lead to increases in overall climate change that will generate even warmer conditions and additional carbon flux to the atmosphere, thus becoming a continuing cycle (a positive feedback to the climate system).

Beyond having degrading impacts on Arctic human and natural systems as described above, such a scenario could certainly lead to a series of global impacts that amplify any and all of the impacts that other regions of the Earth are facing today or will face in the future.

GOVERNANCE ISSUES: TAKING KNOWLEDGE TO STRATEGIC DECISIONS

With respect to climate change and its impacts and effects within the Arctic, and with the inherent assumption that we understand and acknowledge that there are a multitude of international organizations, national politicians and policy makers, regional and local stakeholders (many of whom are some form of decision-makers themselves) and indigenous and local cultures and communities, there are four different yet interrelated options for bringing science and information into political, policy and overall decision-making actions:

- *Mitigation:* Actions taken to promote the reduce greenhouse gases (GHGs) in the atmosphere (including CO_2 and usually methane as well as a host of other gases of less significance). These actions almost certainly must rely on strong international, legally binding treaties, agreements, etc., along with national level executive and/or legislative actions.
- *Adaptation:* Actions taken to promote a change of state of an entity from a vulnerable or unstable condition to a less vulnerable, more resilient and more stable condition. This can occur at any scale and can be conducted under a range of formal to informal conditions. It is important to keep in mind that the likelihood of success of any adaptation action is heavily dependent upon the state of the entity prior to taking adaptive action(s). Thus, the likelihood (and even the magnitude) of adaptation success is enhanced by taking concomitant mitigation action.
- *Climate Engineering:* Any kind of action taken to reduce the concentrations of GHGs already in the atmosphere. This is in contrast to mitigation actions, which reduce the emissions to the atmosphere. Currently, this is not a well-understood option for action since a lack of scientific understanding of these engineering practices could lead to secondary or cascading impacts and effects, some of which might be more disruptive than the primary issue for which the action was intended.
- *Suffer:* The action of doing nothing; this involves taking no steps towards providing mitigation, adaptation, or climate engineering actions. This is the easiest action since it involves doing nothing, but it is also the most likely to produce the least desirable results in providing solutions to the climate dilemma.

PRINCIPLES FOR TAKING INFORMATION TO ACTION

Almost certainly, the action most likely to be taken will involve a combination of at least the first three options (possibly starting with the fourth) integrated within a structured governance model. In all cases, there are some fundamental underlying principles that should be followed when developing a specific governance structure that facilitates bringing information—including science—to action. This governance structure is called the "Science-Decision Cycle."

For years, national and international efforts have relied largely on the development of discrete scientific synthesis and assessment products in order to evaluate past, present and, most importantly, potential future states of one or more aspects of the Earth system, including climate change. These linear studies, broadly classified as assessments, have been valuable in helping different scientific communities develop broad frameworks for describing specific scientific questions, related gaps in our scientific understanding of the issues the questions were addressing, and ultimately, some level of prediction of the future state with an identified level of uncertainty. These assessments emerged from a scientific tradition of "literature reviews" where a small team of experts summarized what was known about a particular topic to form a foundation for subsequent scientific research. Over time, these studies, initially intended for the scientific community, have evolved to include derivative summaries (summaries for policy makers, or SPMs) aimed at communities that may utilize the science in order to inform decisions. These decisions typically include policies and management actions affiliated with the impacts and effects (past, present, and future) on specific or general aspects of the physical, chemical, biological, social, economic and even behavioral systems. And while these SPMs have been a significant achievement in moving science-based information into a greater role of direct societal relevance, their immediate value in providing specific decision-support has been limited. This has primarily been a result of the assessments and the derivative SPMs being developed at levels too technical and scales too coarse for most types and specific cases of actual decision-making, a dilemma typically faced by the science community since the forces driving Arctic changes are global in origin, yet the resulting impacts and effects and related policy and decision-making span scales from local to global.

Adding to this dilemma, in many instances the assessment studies and other forms of relevant information were conducted without significant up-front (i.e., pre-assessment) end-user (i.e., decision maker) collaborative consultations. This resulted in conclusions or recommendations that were meaningful to the scientists who developed the reports but not necessarily directly useful for decision-makers. In fact, this collaborative-consultative process is a prerequisite for ensuring that the science community is aware of the specific issues directly relevant to decision-makers and that the decision-makers, in turn, effectively understand what information can be provided by the science community in order to support the decision-making community's needs.

Over the past several years, through many significant collaborative initiatives, the science and decision-making communities have begun to work together in a more collaborative manner, albeit in limited areas. In doing so, they have begun to develop methods for effective and iterative consultation and decision support product development and the much-needed evolution of the assessment products themselves. Now, scientists and decision-makers of all types are taking additional and significant steps in forming collaborative consultations that are leading to the establishment of issue-based frameworks that identify the science needs of future assessment reports and subsequent derivative products, including SPMs and specific decision support and communication/outreach tools and services. In those examples where such consultations have happened, the outcomes have been positive with a clear understanding of what is needed, what is known, and where the uncertainties lie.

It is important to understand that the evolution of the science assessment process goes much further than just shaping the way that we conduct the assessments themselves. The evolution of the process is a metamorphosis of the entire engagement process between scientists and decision-makers, including changes in the timing and methods through which both parties engage and interact in identifying the issues relevant to

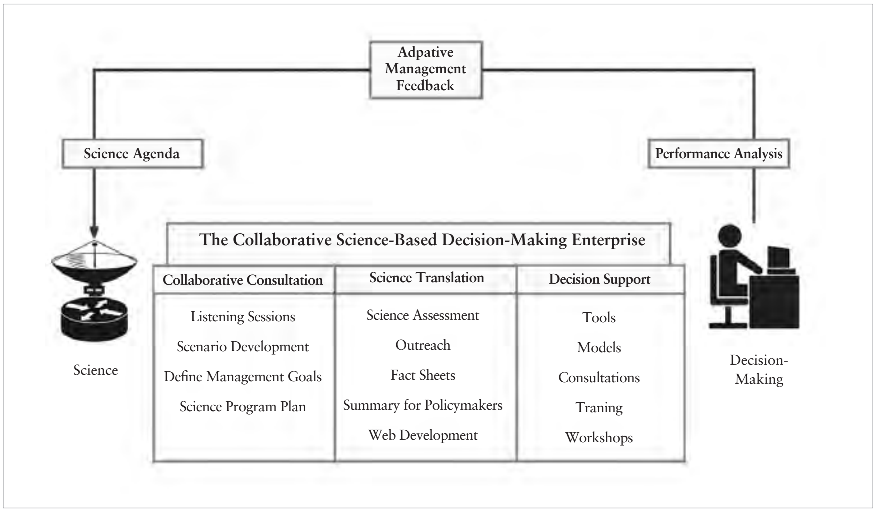


Figure II.4 *The Science-Decision Cycle* decision-makers, the structure and content of the scientific assessments, the science needed to develop the assessments (including prioritization of areas of continued scientific uncertainty), and the nature and types of decision support and outreach tools and services that are provided. Furthermore, the overall framework of the collaborative-consultative process for engagement must be sustainable so that effective decision-making, with products co-designed to address, inform and support decisions around key issues and questions, can occur. It must be highly responsive to complex decision-making issues. Thus, it must include an adaptive management loop, a mechanism that allows for iterative engagement between scientists and decision-makers, focusing on evaluating the performance of decisions already made and subsequent recommendations by decision makers that help identify and prioritize future research investments (see Figure II.4).

FINAL THOUGHTS

This guidance is not intended to be constraining to scientific investigation or creativity. In fact, it is meant to provide the broader foundational collaborative context to which specific regional and pan-Arctic scientific information contributes. From this, all Arctic decision-making communities may be properly informed in order to effectively mitigate, prepare for and adapt to the impacts and effects related to a rapidly changing Arctic.

Commentary

Robert W. Corell

OVERALL PERSPECTIVES ON ARMSTRONG'S PAPER

The outline selected by the Armstrong maps very well to the question: "*Why are changes in the Earth's climate system in and across the Arctic important to the rest of the world?*" The paper addresses the key topics that matter globally, noting that the Arctic region is changing and that the changes are accelerating at rates and levels that have not been experienced by humankind or humankind's ancestors for at least eight hundred thousand years and quite possibly for millions of years. The peoples of the Arctic are facing accelerating challenges that are beyond levels of human experience. For many years, the Arctic has been a world apart detached from mainstream societies. However, over the most recent decades that image has changed dramatically. While wilderness remains a prominent feature of the region, the Arctic and its peoples are experiencing tangible realities arising from climate change, melting ice, increased industrial activities, and the possible development of the region's rich natural resources. These changes have substantial implications for the entire planet, and more particularly for the Northern Hemisphere. Armstrong's article addresses global changes that affect the Arctic region and then goes on to address those changes that are resident within the Arctic but affect the rest of the world and to explore the major consequences from those changes.

Six developments that have global consequences include:

- *Sea Level Rise*—There is an accelerating rise in global sea level with about one-third stemming from the melting of the Greenland ice sheet and other high latitude land-based glaciers.
- *Opening of the Seaway*—The thinning of the Arctic sea ice and dramatic reductions in its areal extent every summer are opening opportunities and challenges for new shipping and trade routes, natural resources development (fisheries, oil, gas, and minerals), tourism, and the residents of the coastal communities along the route, particularly indigenous peoples.
- *Some Weather Extremes are Caused by Processes in the Arctic*—

(a) *More Frequent Extremes:* Recent observations show more frequent extremes across the globe. What were previously observed as one-in-a-hundred-year events now appear to be one-in-twenty-year events or even more frequent.
(b) *Heat Extremes:* Heat extremes in lower latitudes have a significant effect on agricultural production. The impact of temperature extremes on crop production has been well documented with the likelihood of more hot days with record heat and precipitation changes, crop yields are more vulnerable.
(c) *Stronger Hydrological Cycle:* A stronger hydrological cycle, influenced by the polar vortex and changes in the jet stream, appears to be leading to more water per storm across the globe. A warmer atmosphere means more water vapor in the atmosphere, which means individual storms will release more water per storm. Some regions of the Northern Hemisphere have seen a 30 percent increase in such intense rainstorms.
(d) *Simultaneous Extreme Events:* Simultaneous extreme events are likely to increase, storms, such as Sandy, that will cause unprecedented consequences for Northern Hemisphere regions.

- *Ocean Acidification*—The increases documented in higher levels of the Arctic oceans are projected to have economic impacts on marine ecosystems, Arctic fisheries, recreational value of Arctic ecosystems.
- *Thawing Arctic Permafrost*—The major focus has been on the fact that permafrost stores an immense amount of carbon and methane (twice as much carbon as contained in the atmosphere). In a warming environment, permafrost is expected to degrade, and these gases may be released in the decades ahead. Although, studies have suggested that the release has not accelerated substantially in recent years, research suggests that this process has already begun in Western Siberia.
- *Governance Issues: Taking Knowledge to Strategic Decisions*—Four different yet interrelated options for bringing science and information into the political, policy and overall decision-making actions where discussed at length during the open discussion period:

(a) *Mitigation:* Actions taken to promote the reduction of greenhouse gases (GHGs) from the atmosphere (including carbon dioxide (CO_2) and methane as well as a host of other gases of less significance).

(b) *Adaptation:* Actions taken to promote a change of state of an entity from a vulnerable or unstable condition to a less vulnerable, more resilient and more stable condition.
(c) *Climate Engineering:* Less widely discussed but noted as any kind of action taken to reduce the concentrations of GHGs from the atmosphere.
(d) *Suffer:* Also, less widely discussed but noted in passing: doing nothing; this involves taking no steps towards providing mitigation, adaptation or climate engineering actions.

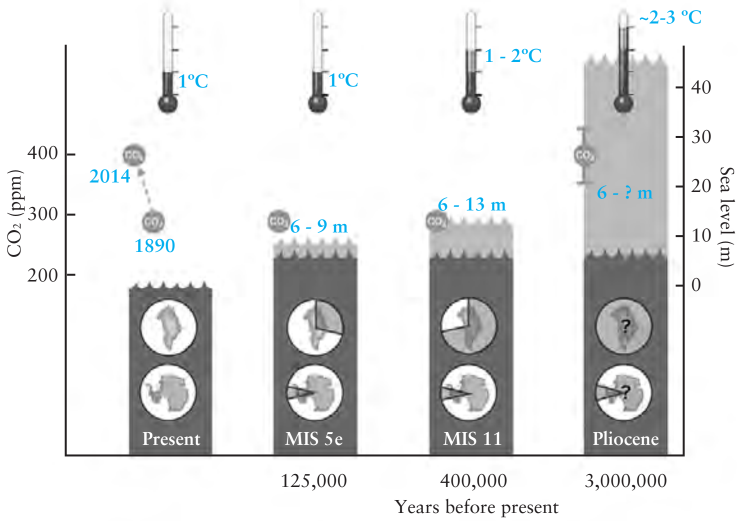
Figure II.5 shows this graphically:

Figure II.5 Global Consequences

OVERALL ADDITIONAL COMMENTARY ON THE MAIN THEMES OF THE PAPER: SEA LEVEL RISE

There is the increasing prospect that humankind is entering a new era of unstoppable sea level rise. Averaged over all land and ocean surfaces, temperatures have warmed about 0.85° Celsius (1.53° Fahrenheit) from 1880 to 2012.[1]

The Earth's system is sensitive to such temperature changes,1 which cause seawater to expand and ice sheets and glaciers worldwide to melt, gradually raising global sea level. Scientific papers and reports are now suggesting we are passing a tipping point, driven increasingly by the heat that is already trapped in the ocean leading to this pattern of expansion and melting that will continue for centuries,[2] as has happened repeatedly in geologic history. Further, with continued global mean temperatures above pre-industrial levels (see Figure II.6), sea level will continue to rise for



Peak global mean temperature, atmospheric CO_2, maximum global mean sea level (GMSL), and source(s) of meltwater.
Light blue shading indicates uncertainty of GMSL maximum. Red pie charts over Greenland and Antarctica denote fraction (not location) of ice retreat.

Source: Dutton, A., Sea-level rise due to polar ice-sheet, SCIENCE10 July 2015. VOL 349 ISSUE 6244

Figure II.6 Temperature Changes Relative to Preindustrial

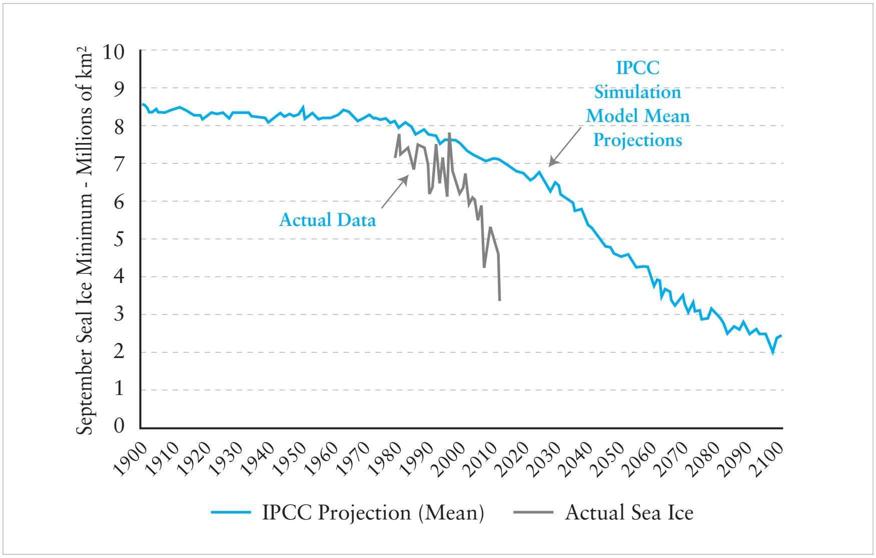


Figure II.7 *Sea Ice has Shrunk Far Faster than IPCC Projections*

centuries, with catastrophic consequences for coastal regions throughout the planet.

Rising seas will permanently move shorelines inland, unlike storm surges and other types of flooding that recede. The financial, political, and social impacts will be without precedent. With trillions of dollars of coastal property and infrastructure, continuing sea level rise is not just an environmental issue, it is a socioeconomic imperative. The "*sleeper*" is the difficulty of estimating the timing of future sea level rise associated with the potential of substantial losses of glacial ice from Antarctica. Research over the past several decades on the implications of losses in West Antarctica indicates that the West Antarctic ice sheet is undergoing an historic thaw, which suggests that the ice sheet could collapse and raise sea levels as much as 3.35 m (11 feet) on century time scales. However, over the past few years, research (see Figure II.7) has produced new evidence suggesting that the collapse could happen faster, largely based on the observations that warmer ocean waters are pushing up from below and bathing the base of the ice sheet.

SEA ICE LOSS: OPENING OF THE ARCTIC SEAWAY

Since the late 1970s, satellite observations have documented that Arctic sea ice extent at its minimum (mid-September) has declined at a rate of about 10 percent per decade, and there is more recent evidence that the rate of decline has accelerated in recent decades. Further, the ability of sea ice models to project sea ice behavior is not adequate to project these changes.[3]

Further, over the past several decades, the accelerated warming of the Arctic has dramatically reduced the volume of sea ice, with the age of 85 percent of the sea ice now only one to two years old. This reality reduces substantially the need for high-powered icebreakers, as the ice is thinner and softer. The opening of the Arctic seaways has several major socioeconomic implications. There is a growing interest in the development of oil and gas deposits in the Arctic, given the projections indicated in Figure II-8. Further, opening of the seaways has increased the interest in transportation to terminals within the Arctic, particularly along the Northern Sea Route (i.e., along the Russian coast) and the potential of trans-Arctic-basin shipping. These socioeconomic and development potentials have been addressed in North Pacific Arctic Conferences (NPACs) since 2011.

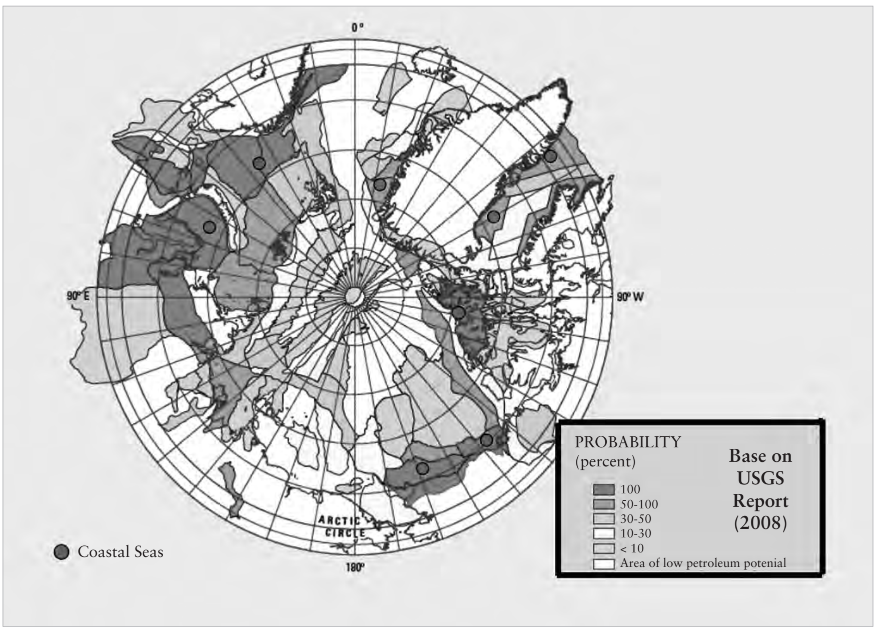


Figure II.8 *Probability of Presence of Undiscovered Arctic Oil and/or Gas Fields*

WEATHER EXTREMES

There is increasing scientific evidence that links rapid warming of the Arctic to mid-latitude weather patterns.[4] As Francis and Skific note, the emergence of Arctic amplification (the enhanced sensitivity of high latitude temperature to global warming) in just the last ten to twenty years shows new evidence of a weakening of the pole-ward temperature gradient that highly amplifies the jet-stream patterns.

These changes in circulation are expected to continue to lead to extreme weather events in the Northern Hemisphere. As emissions of greenhouse gases continue to increase, the occurrence of extreme events is increasingly likely. This effect can be seen in the behavior of the jet stream and its influence on Northern Hemisphere weather (Figure II.9, NASA image).

Further, the ranges of temperature differences across the Arctic region are substantial, as depicted in Figure II.10.

For example, in February 2015, this Arctic impact on Northern Hemisphere weather resulted in extremely low temperatures, running 20° to 50°C below average for this time of year across most of the eastern United States.[5] Many record lows for this date were recorded in major cities

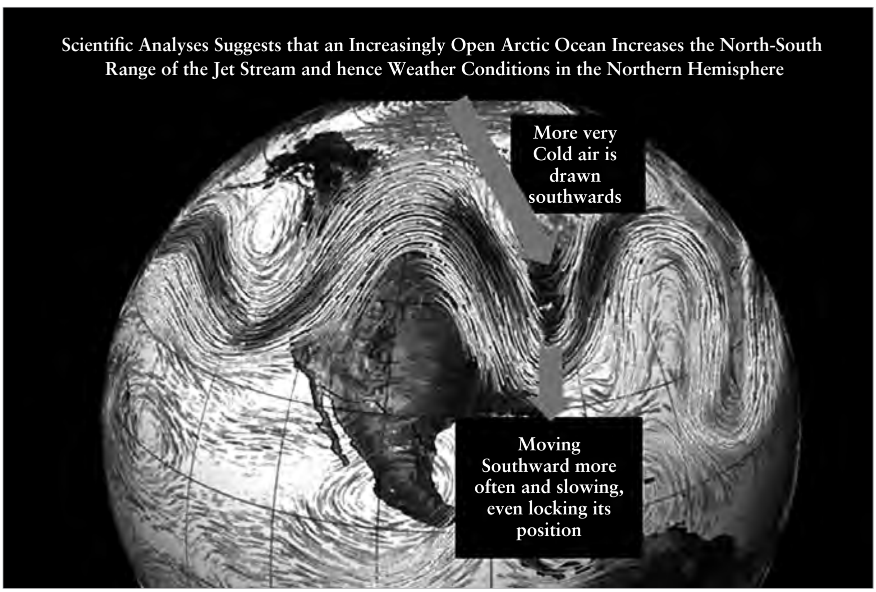


Figure II.9 NASA Jet Stream Analysis

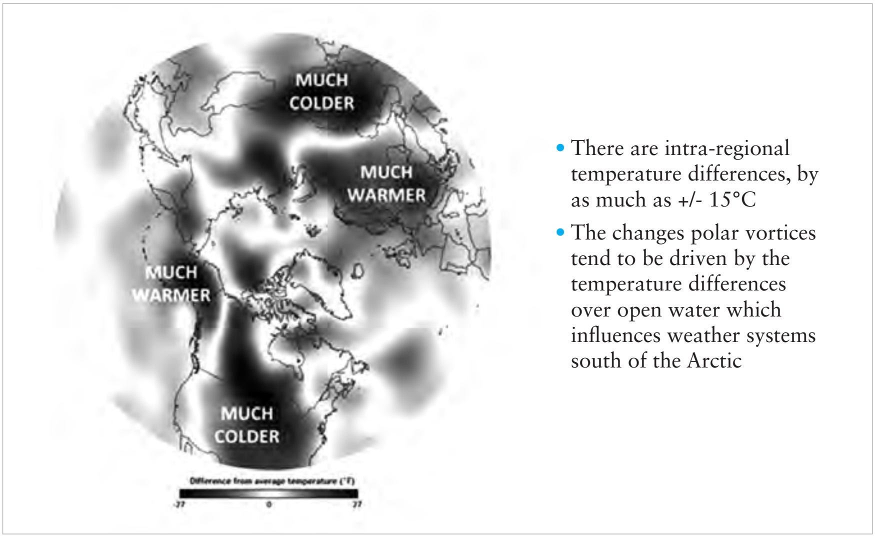


Figure II.10 Consequences of the Changes in the Polar Vortex

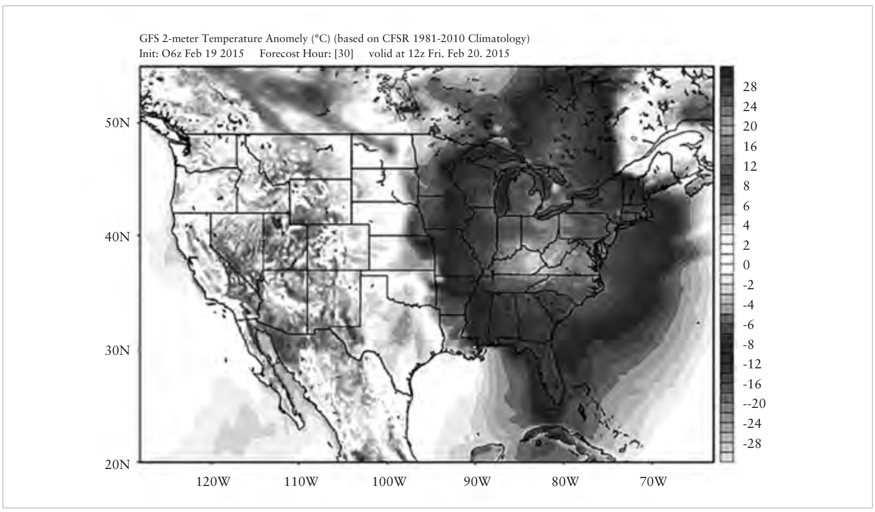


Figure II.11 GFS Two-Meter Temperature Anomaly, 1981–2010

in the eastern United States, including New York, Pittsburgh, Baltimore, Washington, DC, Atlanta, and Miami. The wide range of this condition is depicted well in Figure II.11 (Global Forecast System).

OCEAN ACIDIFICATION

Armstrong describes well in his chapter how increasing concentrations of CO_2 lead to increasing ocean acidification, thereby enhancing calcium carbonate dissolution of calcifying species, depicted in Figure II.12.

Arctic waters are more likely to be affected by ocean acidification because colder waters absorb more CO_2 and hence have higher levels of acidification. In Armstrong's diagram of acidification levels in the Iceland Sea, the seawater pH is already raising ~70 percent faster than the increases in the global mean ocean acidity levels, increases that have been observed and reported in the literature for the past hundred years. Further, acidification levels in the Norwegian Sea are already rising ~200 percent faster than the increases in the global mean ocean acidity levels that have been observed over the past hundred years. As reported by Fosså et al.,[6] the consequences of ocean acidification on fisheries are strongest during the early life stages of fish (eggs and larvae) when they are more vulnerable to calcium carbonate dissolution from changes in water pH. Further, they report that reduced growth may affect the fertility and, hence, is likely to reduce overall survival. As these species are the bottom of the marine food

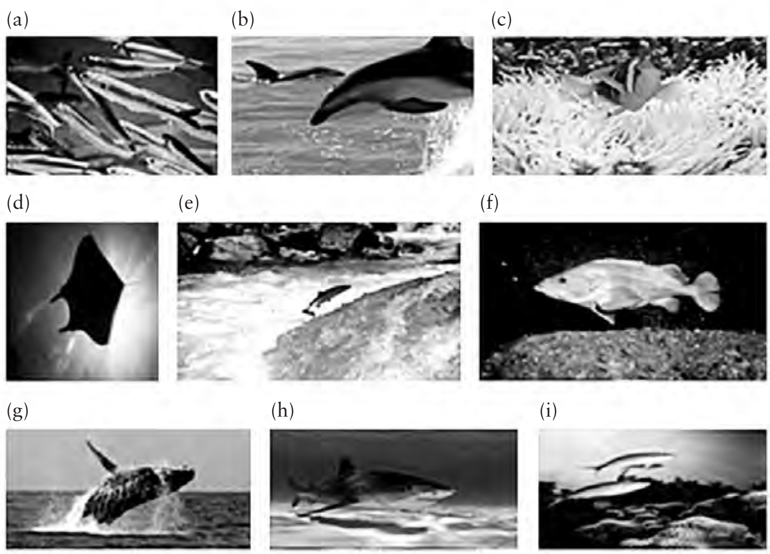
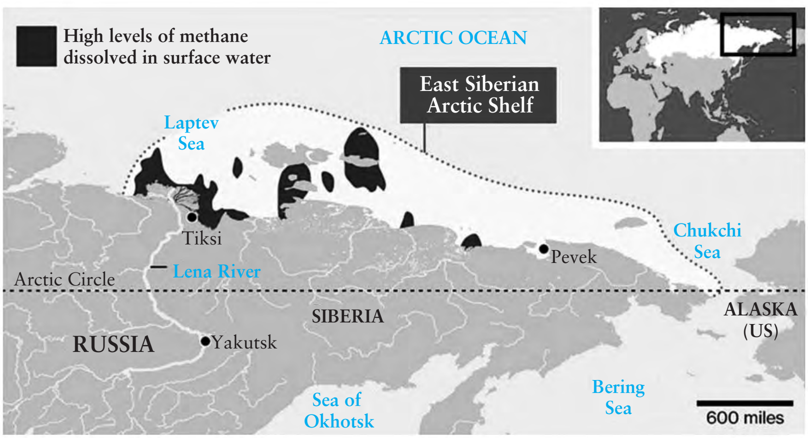


Figure II.12 *Marine Species and Oceanic Food Chain Impacted by Ocean Acidification* chain, the consequences have the potential to affect the species higher in the food chain, as suggested in the previous graphic titled: *Marine Species and Oceanic Food Chain Impacted by Ocean Acidification*. As the following graphic indicates, the essential fact is that acidification disrupts normal development of calcium structures in many important marine species, which means that changes resulting from the acidification of the deep ocean may exceed anything seen in the past 65 million years.[7] As Armstrong notes from the recent IPCC report, *"Ocean acidity has increased approximately 30 percent since the industrial revolution, and the more acidic oceans will have broad and significant impacts on marine ecosystems, the services they provide, and the coastal economies, which depend on them."*

THAWING PERMAFROST

As Armstrong properly notes, the frozen ground of the Arctic is an important, yet poorly understood, element of the entire Arctic system and its connections to the global climate system. There are trillion of tons of carbon locked in the frozen Arctic soils known as permafrost. Until now,



The Russian research vessel Academician Lavrentiev recently conclude a major survey of 10,000 square miles of sea off the coast of eastern Siberia. "We found large plumes of methane bubbles rising to the surface from the seabed … some more than a kilometre across," said Dr lgor Semiletov, "These are methane fields on a scale not seen before. The emissions went directly into the atmosphere." (Reportes of 2012)

Figure II.13 High Levels of Methane Dissolved in Surface Water the interaction of these stores of carbon have not, in upwards of millions of years, interacted with the atmosphere or hydrosphere, affecting the rates and magnitude of the warming of the planet. The Polar Research Board of the National Academy of Science concludes[8] that the near-term potential for catastrophic methane release, from decomposition of terrestrial carbon stocks in permafrost or from the methane ice (i.e., clathrates) is small.

However, the potential for gradually increasing methane and CO_2 releases from thawing permafrost was considered important, and could accelerate and add substantially to the greenhouse gases in the atmosphere over decades to centuries. There have been many reports, field studies, and assessments of the potential of release of methane from these Arctic soils, most of which suggest that the rate of growth of methane in the Arctic is comparable to that in the global atmosphere. However, Russian research

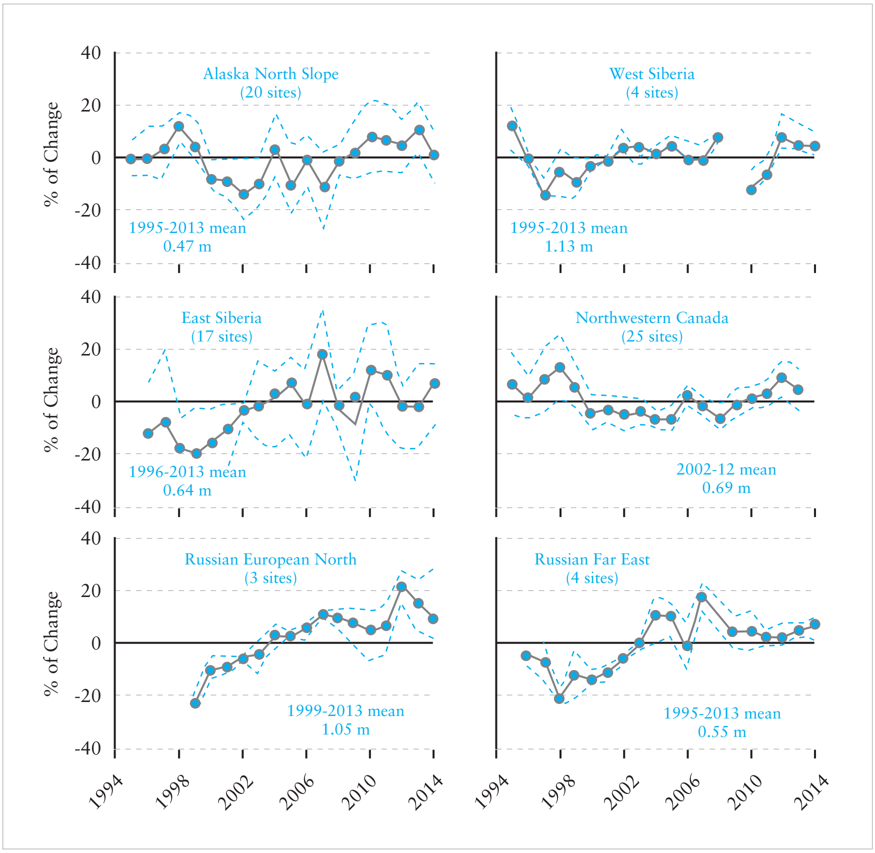


Figure II.14 State of the Climate

has shown substantial releases of methane from the sea in the eastern Russian Arctic, as reported in Figure II.13.

Overall patterns regarding releases of methane are additionally well depicted in Figure II.14.[9]

GOVERNANCE ISSUES: TAKING KNOWLEDGE TO STRATEGIC DECISIONS

This section of Armstrong's article has the potential to add significantly to the discussions of NPAC 2015 and, hence contribute importantly to the content of the book that evolves from NPAC 2015. I would add only these two additional thoughts.

First

The World Economic Forum has conducted a study of "*Climate Adaptation: Seizing the Challenge.*" This report identified five key findings that its members might deploy to adapt to a rapidly changing world, including:

- *Reductions in emissions of greenhouse gases are not happening fast enough*—Preparing societies for the impacts of climate change, i.e., adaptation, must therefore happen in tandem with mitigation efforts.
- *Indices can inform decision makers on where climate adaptation is most necessary, and how best to allocate adaptation investments, including for prioritizing pre-disaster efforts*—African nations, particularly sub-Saharan nations, consistently emerge as the most vulnerable to climate change and the least ready to adapt, while a clear difference appears between developed and developing nations. More and better national data, particularly in developing countries, is required, while obtaining local data for comparison, for example across cities, may be a challenge. Metrics that are used to assess adaptation can have conflicting aims and conclusions but competing methodologies can shed new light on seemingly intractable problems.
- *Up to 65 percent of the increase in the projected losses due to climate change could be averted cost-effectively through adaptation investment*—Decision makers need to look at "total climate risk" when considering adaptation investment and finance. This takes into

account existing risk, future risk due to development, and additional risk due to climate change.

- *Private-sector funding will be needed to finance investments; the cash-strapped public sector will not be able to provide it all*—Public sector funding can be leveraged effectively however and the public sector can also provide a framework that makes this investment attractive.
- *Water, food, and energy systems are inextricably linked and so the use and management and particularly shortages of one can affect another, e.g., water shortages can affect crop yields, power generation, and industrial processes*—It is therefore crucial to consider each part of the water-food-energy nexus when making an investment or policy decision so that another part of the nexus is not compromised. Meanwhile climate change is stressing the nexus. Addressing this is beyond the scope of individual governments, companies, or NGOs. Since awareness of the nexus is low, the current behavior of companies or governments may not take it into account and therefore stress it further. A new approach is required that involves multiple stakeholders with the aim of addressing these issues in a coordinated and holistic manner.

Second

The US National Academy of Sciences has produced a report[10] entitled: "*Informing Decisions in a Changing Climate.*" The academy found that the new climate regime could not have been envisioned from past experience. Moreover, climatic changes will be superimposed on social and economic changes that are altering the climate vulnerability of different regions and sectors of society, as well as their ability to cope (i.e., adapt). Decision makers will need new kinds of information and new ways of thinking and learning to function effectively in a changing climate. Many decision makers are experiencing or anticipating a new climate regime and are asking questions about climate change and potential responses to it that, for example, federal agencies are unprepared to answer. Hence, the panel sought to develop a framework and a set of strategies and methods for organizing and evaluating decision support activities related to climate change.

One of the central results of this study was the development of a set six principles of effective decision support:

- *Begin with users' needs*—Decision support activities should be driven by users' needs, not by scientific research priorities. These needs are not always known in advance, and they should be identified collaboratively and iteratively in ongoing two-way communication between knowledge producers and decision makers. The latter can usefully be thought of as constituencies, collections of decision makers who face the same or similar climate-related events or choices and therefore have similar information needs.
- *Give priority to process over products*—To get the right products, start with the right process. Decision support is not merely about producing the right kinds of information products. Without attention to process, products are likely to be inferior, although excessive attention to process without delivery of useful products can also be ineffective. To identify, produce, and provide the appropriate kind of decision support, processes of interaction among and between decision support providers and users are essential.
- *Link information producers and users*—Decision support systems require networks and institutions linking information producers and users. The cultures and incentives of science and practice are different, for good reason, and those differences need to be respected if a productive and durable relationship is to be built. Some ways to accomplish this rely on networks and intermediaries, such as boundary mechanisms.
- *Build connections across disciplines and organizations*—Decision support services and products must account for the multidisciplinary character of the needed information, the many organizations that share decision arenas, and the wider decision context.
- *Seek institutional stability*—Decision support systems need stable support. This can be achieved through formal institutionalization, less formal but long-lasting network building, establishing new decision routines and mandates, along with committed funding and personnel. Stable decision support systems are able to obtain greater visibility, stature, longevity, and effectiveness.
- *Design processes for learning*—Decision support systems should be structured for flexibility, adaptability, and learning from experience. The study concluded that it is important to analyze the modes of learning in relation to the main challenges of decision support in a changing climate, i.e., evaluate the modes in relation to the decision-

making needs:

(a) *Unplanned learning is a default mode:* The actions are undertaken without any explicit consideration of learning, and any change that occurs is unplanned and often unbidden.

(b) *Conduct a program evaluation:* A program evaluation involves formal assessment, often by outside parties, of a program's effectiveness, with the expectation that adjustments will be made in response.

(c) *Implement adaptive management strategies:* In adaptive management, actions are designed as experiments so that they will perturb the decision environment and thereby generate information useful for future adjustment and improvement.

(d) *Deliberation with analysis is the most powerful mode:* Deliberation with analysis is an iterative process that begins with the many participants in a decision working together to define its objectives and other parameters, working with experts to generate and interpret decision-relevant information, and then revisiting the objectives and choices based on that information.

A series of focal points can be added to more explicitly focus on the narrower question: *What is happening within the Arctic that is important within the Arctic?* The key issues, raised in Armstrong's chapter and expanded here suggest:

- *Address more directly the consequences of change*—Enhanced and effective local adaptation actions (and, where appropriate, mitigation strategies) that address directly the impacts of climate and socioeconomic change, at local levels, that particularly affect the residents of the Arctic, their cultures and well-being, indigenous peoples and other local residents, and the communities and the societal structures within which they reside.
- *Identify opportunities that enhance human and societal well-being*—Activities and actions that constructively extend the socioeconomic and ecological foundations of the Arctic's future, at all geo-political scales.
- *Increase the resilience of socioeconomic and ecological systems*—Identify modalities and methods and implement them in ways that build resilience and reduce the vulnerabilities for all peoples and their

societal foundations.

- *Identify and implement strategies for stewardship*—Establish ways and means that provides for a sustainable future for the Arctic, its peoples, its socioeconomic structures, and its essential ecological systems.
- *Address the human dimensions of change*—There has been some concern we did not adequately address the human dimensions of change and how changes affect Arctic communities.
- *Identify the potential for adaptive actions*—What adaptive actions can local, regional, and national actors take to address the resultant challenges and improve the resilience of Arctic communities, and what role does the Arctic Council's Adaptive Actions for a Changing Arctic (AACA) initiative have in this regard? It is suggested the there are recent reports and literature that address the concept of "smart adaptation" or "intelligent adaptation."
- *Introduce the construct of "The Climate, Energy, Economic Conundrum"*—Assessing the capacity of countries interested in the Arctic to address the interacting elements of climate/energy/economic issues is a potential for programmatic focus by the Arctic community rite large and by interested nations around the world, including the twelve official observer nations of the Arctic Council.
- *Identify more explicitly the role of science in policy processes for the nations with Arctic interests*—Several perspectives where noted:
  (a) Science and knowledge is essential to effective decision-making.
  (b) More science does not equal better decisions, as the real need is to change public attitudes.
  (c) There appears to be a shift in human actions to address climate change, but it is small compared to the explosive growth in scientific information.
  (d) There is a need to emphasize opportunities that build on scientific information, and there should be a major focus on solutions rather than threats.
  (e) There is never too much science to underpin decision-making.
  (f) There appears to be evidence that there is an improvement in the dialogue between scientists and policymakers.
  (g) There was often noted a critical need for a greater focus on and support for social and humanities research.

SUMMARY

Armstrong's paper focuses well on an overall goal—*Climate Change: Policy Implications for the Nations with Arctic* Interests. However, there is still much to do. Use-inspired research, modalities, and enhanced methods need to be improved and extended to enhance policy decisions. Armstrong's "Science-Decision Cycle" strategy is shown again as Figure II.15 as a reminder of its importance.

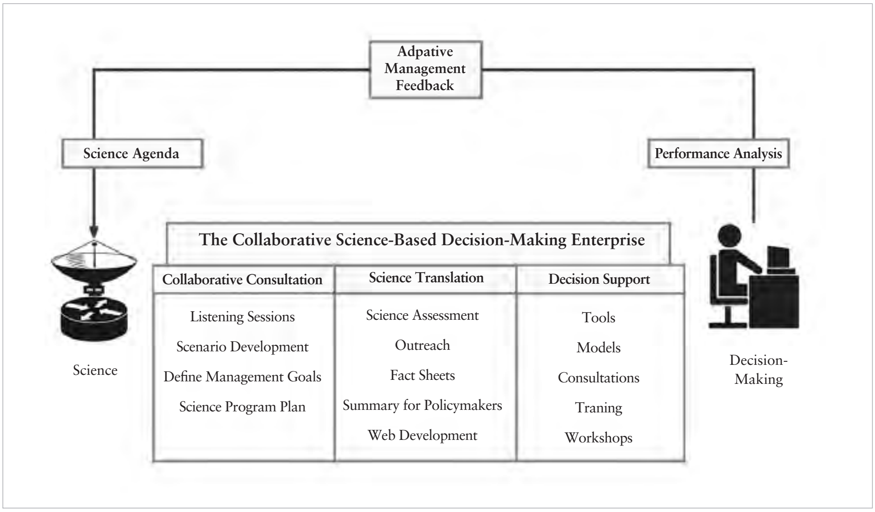


Figure II.15 The Science-Decision Cycle

Notes

1. IPCC WG 1 (2013).
2. M. O. Jeffries, *Physics Today* (October 2013).
3. V. Kattsov et al., "Arctic Sea-Ice Change: A Grand Challenge of Climate Science," *Journal of Glaciology*, 56, no. 200 (December 2010): 1115–21 (7).
4. J. Francis and N. Skific, "Evidence Linking Rapid Arctic Warming to Mid-Latitude Weather Patterns," *Phil. Trans. R., Soc. A* 373 (2015): 20140170. http://dx.doi.org/10.1098/rsta.2014.0170.

5. tropicaltidbits.com.

6. In a study by the Institute of Marine Research and the Bjerknes Center for Climate Research in Bergen, Norway, in their study the *Consequences of Ocean Acidification for Fisheries*.

7. Andy Ridgwell et al., *Nature Geoscience*, 14 February 2010.

8. at http://www.nap.edu/catalog.php?record_id=18373.

9. V. E. Romanovsky et al., “State of the Climate, Terrestrial Permafrost,” *AMS Bulletin* July 2015. Caption for the graphic: “Long-term active-layer change in six different Arctic regions as observed by the Circumpolar Active Layer Monitoring project. The data are presented as annual percentage deviations from the mean value for the period of observations. Thaw depth observations from the end of the thawing season were used. Only sites with at least 10 years of continuous thaw depth observations are shown. Solid red lines show mean values; dashed black lines represent maximum and minimum values.”

10. http://www.nap.edu/openbook.php?record_id=12626.

Commentary

Raymond V. Arnaudo

The importance of science in Arctic cooperation cannot be overestimated. While the first coordinated review of U.S. federal Arctic policy took place in 1971, subsequent reviews have produced a consistent policy since that time. Scientific and research cooperation was one of the original four (expanded to six after the 1983 Arctic policy review) principles. The others include:

- the protection of our national security interests and the preservation of the principle of freedom of the seas and superjacent airspace;
- 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 environmental protection; and
- the engagement of indigenous and local communities.

The past two decades have witnessed an evolutionary trend and growth in the perspective of the United States to welcome greater structured international and multilateral cooperation, which has resulted in more cohesion and better communication among Arctic countries.

There were earlier examples of pan-Arctic cooperation, such as the Spitsbergen Treaty of 1920 that recognized the sovereignty of Norway over the Svalbard Archipelago, while providing for the demilitarization of the islands. Others addressed questions of natural resources management and conservation: the North Pacific Fur Seal Convention (1911, amended in 1957) and the Polar Bear Agreement (1973). These types of cooperative arrangements have had the overriding purpose of broadening cooperation among the jurisdictions of the five Arctic counties, Canada, Denmark (Greenland), Norway, the United States, and Russia (formerly the Soviet Union), but always stressing the need for a strong foundation of information built on science.

After World War II and until the fall of the Soviet Union, the political tensions between East and West constrained dialogue about multilateral cooperation in the Arctic, although cooperation in the area of science always provided for outreach between the scientific communities. With the

Soviet Union on one side of the equation and the United States, Canada, and Nordic countries on the other, many efforts to reach across this divide were stunted, although some government agencies did work together on specific problems, mostly bilaterally and almost exclusively in the realm of science.

It was science, and the growing political strength of indigenous communities, which frequently led the way to greater cooperation. In the United States, Congress passed the Arctic Research and Policy Act of 1984. This created an Arctic Policy Group, chaired by the State Department under the authority of the National Security Council of the president and the Interagency Arctic Research Policy Committee chaired by the National Science Foundation. The Act also established an independent US Arctic Research Commission to oversee and coordinate US scientific efforts in the Arctic. These new intergovernmental bodies would bring greater focus to the growing importance of the Arctic and would organize the coordination of science and research funding by the federal government for the first time.

At the same time, native groups in the North were consolidating their influence. Representative of indigenous peoples and native populations would occasionally meet to discuss transboundary cooperation. In 1977, a multinational gathering of indigenous peoples took place in Barrow, Alaska and created the Inuit Circumpolar Conference (now Council), thus organizing a voice for the natives of the North. Its efforts would lead to a unique role for indigenous representatives in the Arctic Council and other international organizations.

In the late 1980s, academics were bringing colleagues together and initiating consultative processes bringing together government representatives, including some from the Soviet Union, which would eventually lead to increased collaboration. These discussions, led by Arctic scientists, would lead the Russians to explore ideas that were formally articulated in Gorbachev's now-famous Murmansk speech in 1987, which communicated to the other Arctic countries that the Soviet Union was interested in greater cooperation.

Scientists also began to press for improved pan-Arctic cooperation to enhance research interactions. They began discussions by drawing Arctic and non-Arctic countries together and eventually agreed to form the International Arctic Science Committee (IASC) in 1990. IASC was the first pan-Arctic scientific body to be established; its goal was to initiate, develop, and coordinate scientific activity in the Arctic region, and on the role of the

Arctic in the Earth system. The creation of IASC would highlight the need for international governance in the North.

Shortly thereafter, the Finnish government's efforts to create a more welcoming forum for dialogue in the North would result was the creation of the Arctic Environmental Protection Strategy (AEPS 1991) adopted in Rovaniemi which would be broadened by the Ottawa Declaration to become the Arctic Council in 1996. It is important to note that the original working groups of the AEPS, those structural units which were designed to provide the basis for the work of this Arctic forum, were heavily science-based, especially the Arctic Monitoring and Assessment Programme (AMAP).

In this way, science has lead the way for ever greater interaction and cooperation in the Arctic. It is now playing a similar role in the growing awareness of the threat of climate change from global warming. By documenting increasing temperatures and rising sea levels, the scientific community has raised the consciousness of the world community regarding the need for action. Just as in 2000, when the Arctic Council would respond to a US initiative to begin crafting its Arctic Climate Impact Assessment, the council is being asked to consider future measures and actions to address global concerns over the warming of the planet. The Arctic, like the Antarctic, has been one of the first areas of the globe to manifest the impacts of global warming. It is, therefore, well positioned to make the case for swift and well-planned actions in response.

The United States, as the present chair of the Arctic Council, has outlined its goals for the next projected two years. These include three balanced thematic areas:

- healthy Arctic communities;
- Arctic climate change; and
- Arctic Ocean stewardship.

Within these areas, the United States will:

- continue strengthening the council as an intergovernmental forum;
- introduce long-term priorities into the Arctic Council; and
- raise Arctic and climate change awareness domestically and across the world.

More specifically, the United States intends to:

- support Arctic-focused exchange programs, such as the Fulbright Arctic Initiative, that increase international scientific collaboration and mutual understanding;
- organize social-media campaigns, special events, media engagements, and other public-outreach initiatives that focus on key issues such as climate change, renewable energy, economic development, ocean stewardship, and unique cultural/social issues, and
- develop public-private partnerships among civil society, government, the private sector, and other partners who operate in the Arctic to spur investment and move major projects forward (e.g., in areas such as telecommunications infrastructure).

In should be noted that under its goal of "Climate Change," the United States has focused attention on two specific areas: (1) black carbon and (2) adaptation problems for Arctic communities. Both of these will draw significant attention for their Arctic-based relevance.

Black carbon emissions are notably problematic in ice-covered areas, because the pollutants turn the white reflective surfaces into dark absorbent ones, a serious problem for the white North. And adaptation problems for communities will emphasize the human dimensions of this global threat, such as the displacement of coastal communities, the impacts of permafrost melting, and changes in animal migration patterns, to name a few. Under its other goals, the United States will also address the issues of marine protected areas, renewable energy, and water and sanitation, all of which are impacted by climate change.

The solutions to the problems of climate that will have direct impacts on the Arctic region will be addressed in global negotiations under the UN Framework Convention on Climate Change. But the Arctic nations, through the efforts of both their scientists and their diplomats, are in the unique position of being at the front lines of the action, where the changes are impacting the land and its inhabitants more significantly than in the rest of the world.

Finally, any discussion of the role of science in negotiations and global cooperation must address the problem of communication between the science community, the negotiators, and the public. Scientific presenters may think that "the facts speak for themselves," but the data and conclusions need to be understood by the policy makers. Scientists must be prepared to speak in language that will be understood by non-technical types, rather than in the jargon of their trade. The science community also needs to balance its efforts to be fair and balanced and be willing to explain alternative conclusions, with the need to focus on the best conclusions.

Arctic countries have made remarkable progress in recent decades in strengthening their cooperation, and much of that success has been started and continued by scientific research. Even during the trying times of the Cold War, as wellas under the current difficult times regarding relations with Russia, scientific research on a host of Arctic issues continued and fostered the eventual political progress which led to the formation of the Arctic Council. In this regard, Arctic nations will continue to advance scientific understanding that will provide the basis for assessing the future impacts of climate change and proposed response strategies.

Commentary

Joan Nymand Larsen

A DECADE OF ACCELERATING CHANGE IN THE ARCTIC

The paper by Armstrong starts out with a summary of the National Oceanic and Atmospheric Administration (NOAA) 2014 *Arctic Report Card*. Arctic change is happening as widely documented by the Intergovernmental Panel on Climate Change (IPCC, 2014), the *Arctic Human Development Report* (AHDR, 2014), *State of the Arctic Coast 2010* report (2010), various Arctic Council and *Arctic Monitoring and Assessment Programme* (AMAP) reports, and Summaries for Policy Makers (SPMs), etc..

What is not covered by the Arctic Report Card, but covered in other assessments such as IPCC (2014) and AHDR (2014), are the changes occurring in the human systems and their impacts on peoples, societies, and living conditions in the Arctic. It is important to emphasize in the present context that there is general agreement today that change in the Arctic must be seen and understood also as a complex set of different systems and their interactions, including the human systems.

The importance of considering Arctic change within the context of interconnected factors is emphasized in the following executive statement from the Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report (AR5 2014):

> *The physical, biological, and socioeconomic impacts of climate change in the Arctic have to be seen in the context of often interconnected factors that include not only environmental changes caused by drivers other than climate change but also demography, culture, and economic development. (Larsen et al. 2014, 1570).*

The complexity of interactions is further emphasized in the statement that:

> *Climate change exacerbates the existing stresses faced by Arctic communities, and is only one of many important factors influencing*

adaptation. High confidence. (Larsen et al. 2014, 1593).

Without diminishing the importance of climate change as one of the key factors, it is a widely accepted fact today that there are many drivers of rapid Arctic change, of which climate is only one. In the words of the Arctic Council (2013):

The Arctic is changing rapidly in ways that interact and fundamentally affect the region's ecosystems and societies. Climate change is important, but it is not the only driver of rapid changes in the Arctic. In many contexts, social, political and economic drivers may be of greater importance than global warming. (Arctic Council 2013, x)

The past decade has witnessed further and increased intensification of environmental and socioeconomic changes. While change has been a characteristic of Arctic societies since early history, today the pattern of change differs from the past in its magnitude, its rate of change, and the complexity of Arctic changes. Melting sea ice, thawing permafrost, more variability in weather, and other changes pose well-documented challenges to Arctic residents. During the past decade, we have witnessed a dramatic increase in interest in the Arctic, in part due to the continued rapid and even accelerating socioeconomic and climatic changes in this region. A record-low sea ice extent in the Arctic Ocean in 2012 has left the global community both alarmed and excited, as concern over negative impacts of climate change has been countered by a potential promise of certain economic benefits, including greater accessibility to the Arctic region's natural resources and increased marine transportation in the Arctic Ocean. The new and observed pattern of change will produce significant impacts on the Arctic region in the years to come, from main population centers to smaller local and indigenous communities. The IPCC 2014 "Polar Regions" chapter, for example, finds that "there is increased evidence that climate change will have large effects on Arctic communities, especially where narrowly based economies leave a smaller range of adaptive choices"; and further that the "impacts on health and well-being of Arctic residents from climate change are significant and projected to increase—especially for many indigenous peoples" (Larsen et al. 2014, 1571).

Similarly, the 2014 edition of the AHDR, the second report in a series of assessment reports written for a variety of audiences including the Arctic

Council to help inform its work (especially the work of the Sustainable Development Working Group (SDWG), concludes that "the combination of rapid and stressful changes highlighted in the first AHDR (2004) continues today, amplified in rate and magnitude. These societal and environmental changes confront Arctic residents, local communities, and socioeconomic sectors and challenge their wellbeing" (Larsen and Fondahl 2014, 21).

To provide a quick overview of the societal and human dimensions' aspects of Arctic change, it is useful to quote briefly the cross-cutting trends presented in the recent AHDR (2014) as they have relevance for the task of identifying potential strategies for adaptation to global change:

- intensified migrations, both within the Arctic, and between the Arctic and other global regions;
- increasing penetration of new ideas, norms and values into and across Arctic space due to new communications technologies and educational opportunities;
- growing interest in Arctic resource development from a variety of players, Arctic and non-Arctic;
- devolving governance structures that both enable and challenge northern communities;
- accelerating geopolitical maneuverings and policy developments incited by both an increasingly accessible Arctic and by changes in political rapport between the (non-Arctic) centers of the Arctic states, as well as by relations between Arctic and non-Arctic states; and
- trends and needs in the development of human capital (Fondahl and Larsen 2014, 33).

These trends interact with key drivers of Arctic change, including climate change. Of particular interest here is the well-documented trend that shows a growing interest in Arctic resource development from a variety of players, Arctic as well as non-Arctic.

CLIMATE CHANGE IMPACTS

Armstrong's chapter sets out to "describe the major Arctic climate change impacts and effects that are being recognized and predicted throughout the Arctic" and that are "the predominant issues that keep coming up in the many stakeholder engagements...”

This commentary will address briefly some of the points made by Armstrong on climate change impacts relating to each of the paper’s five categories: sea level rise, sea ice loss, weather extremes, ocean acidification, and thawing permafrost. As a start, one might challenge the paper’s assessment of what the predominant issues for Arctic stakeholders are. Issues not mentioned—culture, tradition, and health—are in fact often the items in focus in various stakeholder fora including meetings of the Arctic Council and its SDWG.

The present commentary will seek to cast some additional light on the importance of the human dimension in the context of climate change—in particular indigenous issues and the direct and indirect health impacts of climate change as well as the (cautious) optimism surrounding questions of the economic impacts of climate change in the Arctic.

Armstrong’s chapter is tilted toward consideration of resource extraction and marine shipping issues. Less attention is given to indigenous issues, human health and well-being, and infrastructure. In the IPCC AR5 (2014) assessment on polar regions, greater emphasis was placed on the human dimensions of climate change impacts and observations compared to previous IPCC assessment reports. In particular, climate change impacts on indigenous peoples received more attention because indigenous peoples are especially vulnerable to climate change.

The main categories of Armstrong’s chapter and their related impacts will be considered here:

- Sea level rise—A central point put forward by Armstrong is that previous estimates have been biased toward minimum estimates, or even underestimates, and that new estimates show significantly higher values for sea level rise, with consequences for millions of people and vulnerable coastal communities, in the Arctic and beyond.

  Assessment of the impacts of sea level rise were also included in the IPCC (2014) “Polar Regions” assessment, which found that sea level rise, together with other climate factors, is forcing the relocation of some indigenous communities, including low-lying coastal communities such as Shishmaref, Alaska, United States, and Tuktoyaktuk, Northwest Territories, Canada, and with threats posed also to community and public-health infrastructure. Climate-related impacts on indigenous communities, such as those involving relocation, loss of traditional subsistence species and livelihoods, and health infrastructure, are affecting mental health. There is also evidence of an increase in the number of suicides related to various sources of climate change and their impacts for some regions.

- Sea Ice Loss—As emphasized by Armstrong, the Arctic Ocean will be nearly ice-free during the summer months by 2040 according to predictions made by current Arctic summer sea ice extent models. Similarly, according to the IPCC (2014), the Arctic Ocean is projected to become nearly ice free in summer within this century. The loss of sea ice will have significant impacts for human populations. Armstrong does not detail the impacts on indigenous ways of life. These, however, receive wide coverage in the current IPCC assessment: e.g., with reference to Inuit populations "issues revolve around sea ice conditions, such as later freeze-up in autumn; earlier melt-out and faster sea ice retreat in the spring; and thinner, less predictable ice in general," producing more difficult access to hunting marine mammals, and greater risk for the long-term viability of subsistence species such as the polar bear. This has economic implications, including for informal economies (Larsen et al. 2014, 1585).

  Armstrong highlights three impacts of sea ice loss as being the most significant: (1) global shipping, (2) oil and gas exploration and extraction, and (3) maritime security. While these are arguably important economic impacts, there are other challenges that need to be addressed.

  As regards maritime transportation, IPCC (2014) presents evidence on the differences in projected maritime accessibility: e.g., "[p]rojections made by Stephenson et al. (2011) suggest that all five Arctic littoral states will gain increased maritime access to their current exclusive economic zones, especially Greenland (+28 percent), Canada (+19 percent), Russia (+16 percent), and the United States (+15 percent). In contrast, Iceland, Norway, Sweden, and Finland display little or no increase in maritime accessibility" (Larsen et al. 2014, 1592). Hence, impacts on accessibility vary significantly depending on the region. Furthermore, important challenges need to be addressed, including the issues of security and risk, and indeed basic questions of who defines the acceptable level of risk. A longer shipping season and improved access to ports may also lead to increased petroleum activities, although possible increased wave activity and coastal erosion may raise the costs related to infrastructure and technology.

On the question of oil and gas exploration, Armstrong notes that, with the decline in summer sea ice, oil and gas activities may become more economically feasible in a summer sea ice-free Arctic Ocean. It is useful to acknowledge in this context, although nothing new, that economic activity and industrial development and resource extraction activities are driven also by changes in global markets. While much is made of the changes in accessibility due to climatic warming, global commodity markets and price fluctuations play a decisive role in these developments. Furthermore, while new resource extraction projects are underway in the Arctic, they are not progressing without difficulties. According to Larsen et al. (2014), owing to high costs and difficult access conditions, the impact of climate change on future oil and gas production in the Arctic remains unclear. While the projected declines in sea ice cover may stimulate further exploration and development of mines, the challenge will be the predicted contribution to the spread of contaminants as well as the significant negative impacts on traditional ways of life.

Furthermore—and to continue with the issue of impacts on local and indigenous communities—large-scale resource development in the Arctic has the potential to impose significant economic costs on local and indigenous communities. The appropriation or degradation of assets critical to local livelihood strategies may leave some local communities more vulnerable and with increased risk of being left with insufficient resources to support their living (Larsen and Huskey 2015).

Further to this, and as summed up in the AHDR (2014) executive summary setting forth major trends:

Expectations are high for the expansions of resource extractive industries; we note also the growth in importance of non-resource extractive industries. Interest in economic diversification, within and beyond extractive industries, is rising. While optimism surrounding resource extractive activities remains, so does the high cost of doing business in the North. Climate change is not likely to change this reality, as benefits related to increased accessibility will be balanced or even outweighed by infrastructure damage (Larsen and Fondahl 2014, 22).

Additionally, major trends in the Arctic economy suggest that northern resources will be developed for the international resource markets only when market participants expect the development to be profitable; that the Arctic will remain a high-cost region, with only transport cost being positively affected by climate change; and that while warming may open the Arctic seas for transportation and the continental shelf for development, the sea ice will be unpredictable. In addition, the reduction in permafrost and snow cover will increase production costs, and thawing ground may destabilize existing systems of roads and pipelines, Also, the non-resource-extractive portion of the northern economy is growing in importance, raising interesting questions about the future of the Arctic economy (Huskey et al. 2014).

It is important to consider as well that much of the value of what is being produced in the Arctic does not remain in the Arctic. In fact, the size of the Arctic economy can be underestimated (when informal-sector activity is excluded from calculations of Gross Regional Product) and overestimated (when income and payments flow out of the region), both of which are common problems. Problems with measures of economic performance in the Arctic complicate the task of assessing the contribution to local areas of engaging in resource development and may mask the size of the actual benefits of resource-extraction activities. This may raise interesting questions regarding effects on the optimism that surrounds economic activities in the future as the climate continues to change.

Finally, let us not forget that much remains the same even when change is occurring on many fronts. Economic outcomes and the industrial structure, conduct, and performance in the Arctic will no doubt continue to be affected by small size, remoteness of scattered towns and villages, high costs of production, long distances to markets, and the perennial high levels of economic uncertainty that characterize the Arctic.

- Weather Extremes: Armstrong enumerates the various characteristic features of extreme weather events, including heat extremes, which will have an increasingly significant effect on human health. For a more complete picture of the impacts of extreme weather events, it is useful to consider the details on both direct and indirect health impacts. As emphasized by IPCC AR5 (2014), the increasingly unpredictable, long duration, and/or rapid onset of extreme weather events may create risks to safe travel or subsistence activities, loss of access to critical supplies and services to rural or isolated communities, risk of being trapped outside one's own community, respiratory and cardiac stress associated with extremely warm summer days, and increased air pollution, leading to a rise in mortality. The indirect effects include a complex set of impacts of the physical environment (e.g., sanitation, infrastructure, and water supply and waste systems) with associated impacts on health (Larsen et al. 2014).

- Ocean Acidification: Armstrong writes that "with all of these potentially significant impacts and related consequences, acidification of the Arctic Ocean is poorly understood, under-observed and under-researched." Similarly, the IPCC AR5 (2014) found that additional studies are needed to scale up regional impacts to assess the impact of ocean acidification on Arctic pteropods and other vulnerable species. There is "insufficient data to fully assess the ecosystem consequences of acidification on pteropods because it is unclear whether other species, with a similar nutritive value, will replace pteropods" (Larsen et al. 2014). As regards commercial species, only a few studies have been conducted; on red king crab and juvenile walleye pollock respectively, with contrasting results. Still, this is a topic of increasing importance to the Arctic, and AMAP has more recently published a full report on ocean acidification.
- Thawing Permafrost: According to the IPCC AR5 (2014) permafrost temperatures have increased since the 1970s. Armstrong does not detail the impacts on indigenous communities, health, and urban areas of changes in permafrost. The IPCC AR5 (2014) finds that infrastructure and related services in the Arctic will be affected by thawing of permafrost, and that "particular concerns are associated with damage to residential buildings resulting from thawing permafrost, including Arctic cities; small, rural settlements; and storage facilities for hazardous materials" (Larsen et al. 2014, 1570). While much literature emphasizes the impacts on rural settlements, Arctic cities are also impacted by thawing permafrost. This will become a growing challenge in terms of both social and economic costs as current trends in Arctic living conditions feature an increasing out-migration from local communities to cities and urban areas, with increasing population concentration.

ADAPTATION

On the topic of moving forward in response to the significant volume of evidence on observed and projected Arctic changes, Armstrong writes that "the question now must shift to identifying and developing an integrated strategy for long-term mitigation of carbon pollution to the atmosphere, while in the short-term developing effective strategies for preparing for and adapting to the inevitable impacts and effects that are consequences of our heretofore absent strategy for addressing the climate change problem effectively." Armstrong makes the important point that it is in the area of adaptation and mitigation that a wide array of potential actions is possible at all scales and at all levels of decision-making.

This is an important statement. Further to this, and on the topic of the need for adaptation, the IPCC AR5 (2014) includes among key executive summary points the following statements:

> *The rapid rate at which climate is changing in the polar regions will impact natural and social systems and may exceed the rate at which some of their components can successfully adapt"; and*
> *"Climate change exacerbates the existing stresses faced by Arctic communities, and is only one of many important factors influencing adaptation. High confidence. (Larsen et al. 2014, 1570).*

Hence, it is not only a matter of finding workable strategies for adaptation, but equally one of undertaking adaptation while the potential to adapt still exists, with the rapid rate of change potentially exceeding the rate at which systems can successfully adapt, e.g., in the case of inaction or maladaptation.

Furthermore, the IPCC AR5 (2014) approach includes the identification of a small set of key risks for each region in the world. For the polar regions, these are:

> *Risk #1: "Risks for freshwater and terrestrial ecosystems (high confidence) and marine ecosystems (medium confidence), due to changes in ice, snow cover, permafrost, and freshwater/ocean conditions, affecting species' habitat quality, ranges, phenology, and productivity, as well as dependent economies";*
> *Risk #2: "Risks for health and well-being of Arctic residents, resulting from*

injuries and illness from the changing physical environment, food insecurity, lack of reliable and safe drinking water, and damage to infrastructure, including infrastructure in permafrost regions (high confidence)";
Risk #3: "Unprecedented challenges for northern communities due to complex inter-linkages between climate-related hazards and societal factors, particularly if rate of change is faster than social systems can adapt (high confidence)" (Larsen et al. 2014, 1594).

With the key risks identified, the level of risk was assessed for different timeframes (present, near-term, and long-term) at different degrees of warming (2° or 4°C) followed by an assessment of the potential for adaptation and the related change in level of risk.

This approach has illustrated that adaptation potential exists when appropriate adaptation measures are implemented. Examples of adaptation measures include: co-production of more robust solutions combining science and technology with indigenous knowledge; enhanced observation, monitoring, and warning systems; improved communications, education, and training (ibid.). Examples of indigenous adaptation strategies have included community freezers, changing resource bases, shifting land use and/or settlement areas, changing timing and location of hunting, and improving communications infrastructure and education.

What needs to be highlighted in this context is the importance of traditional knowledge. Armstrong does not address the role played by traditional knowledge. However, this form of knowledge is increasingly acknowledged as a critical component in addressing the impacts of environmental and other changes and in the development of appropriate adaptation strategies for indigenous communities. Traditional knowledge is being combined with scientific knowledge, acknowledging the importance of different types of knowledge in developing more sustainable adaptation strategies.

Considerable progress has been made in our understanding of the Arctic region. A great push forward was provided by the International Polar Year, which helped facilitate an increase in the level of participation of Arctic residents and indigenous peoples in research and science planning at all levels. It also contributed to making Arctic research more inclusive and cross-disciplinary. Significant advancements were made with respect to understanding the importance of local and traditional knowledge.

SCIENCE—POLICY

Scientific assessments are becoming increasingly important to science-based evaluations. These assessments provide the basis and language for bridging the gaps between science and policy. Assessments and SPMs have become sharper and, while often highly technical in their language as pointed out by Armstrong, much is also being done to find ways to translate the science into popular or layman's terms, making it more accessible to larger and more diverse audiences as in the case of the IPCC assessments, SPMs, Arctic Council reports, and the AHDR vol. I and II, acknowledging that the future of the Arctic is also in the hands of those outside of the region and these audiences need to be informed as well.

Review processes have become more rigorous. IPCC assessments are known for their rigorous and multi-stage review processes and their final plenary sessions with representatives of governments. A publication such as the AHDR has benefited from the close collaboration with the Arctic Council and the multiple rounds of review (e.g., by members of the council's SDWG). This has proven to be a good and effective way for a science project such as the AHDR to engage with a broad spectrum of the stakeholder communities and ultimately to achieve better outcomes. On the downside, a recurring problem has been the lack of financial resources to ensure broader representation and engagement of some stakeholders, in particular indigenous representatives. While a key trend in Arctic development is the observed greater self-determination and autonomy of Arctic peoples, the constraints on human and fiscal resources may limit the ability of local and indigenous representatives to participate fully as demands on their time are increasing and resources are already stretched thin.

As Armstrong emphasizes, assessments and SPMs, including those of the Arctic Council, have become increasingly important. With the increasing interest in the Arctic due in part to the rise in the region's geopolitical importance, the eight Arctic states are attending more to the issues of their northern areas; new policy strategies regarding these regions are being formulated; and non-Arctic stakeholders are increasingly pursuing their interests in the Arctic as well, including seeking observer status in the Arctic Council. These developments have also meant that endorsed projects are being increasingly scrutinized by council representatives during project and review stages, perhaps, in the end, leading to a further bridging of the gap between science and policy.

In some sense, we are witnessing a type of paradigm shift in how we approach questions on global change, from a paradigm of "impacts" to a paradigm of "interactions." Societal responses to Arctic change are not only a matter of responding to impacts, they are becoming a much more complex pattern of responses over time to anticipated, observed, experienced, and learned changes in the Arctic system. This paradigm shift demands our closer collaboration across scientific disciplines and with various stakeholders and levels of government.

Finally, on the issue of top-down and down-scaling: there is increasingly broad agreement that Arctic change with its attention to the human dimensions calls for different processes than those customarily used in physical and natural sciences of down-scaling global or regional scenarios of change. There is a complex interplay of factors at the local level and Arctic social sciences have contributed to an enhanced understanding of the limitations of the dominant top-down scenarios in environmental modeling. According to the IPCC AR5 (2014), the lack of local-scale climate projections often acts as a barrier to adaptation.

There might be a sense in the science community that if more information or better explanations are provided, then people will surely act and respond. But because of the local dimensions of peoples, cultures, societies of the issues, remaining top-down approaches may not be effective or sufficient approaches. Many policies risk failing when the science community believes that better science will automatically lead to better decisions without fully understanding the specific situation locally within which the information is to be used.

IMPORTANT ARCTIC SUCCESS STORIES

In addressing the questions of moving forward and finding answers to the questions of a sustainable future and strategies for adaptation, it is useful to remind ourselves that, aside from the challenges faced by the Arctic region in these times of rapid changes, there are also many observed and emerging success stories that need to be told; they may contribute to guiding the way forward in addressing the climate challenge. Some of these have been highlighted in the AHDR (2014), including the increasing use of indigenous knowledge; the increase in local participation, control, and ownership;

the continued growth of innovative governance arrangements; and the emergence of Arctic identities and a sense of northern identity becoming an asset.

GAPS IN KNOWLEDGE

As a concluding point, developing effective strategies toward meeting the climate challenge requires that we address some of the most urgent and critical gaps in knowledge, in terms both of issues of climate change and its impacts and of other sources of change that interact with climatic stressors.

For example, important gaps in knowledge and areas for further research highlighted by the IPCC AR5 (2014) include issues of coupling among, and thresholds within, biophysical and socioeconomic processes; integrated models including those on socioeconomic systems; and coordinated networks for monitoring and assessment, including of impacts in human systems (Larsen et al. 2014).

A series of important gaps in knowledge are also highlighted in the recent AHDR vol. II (2014). Among these are the needs of Arctic youth and elderly; reevaluation and adjustment of Arctic social indicators and monitoring of human development to better reflect the impact of global changes, as well as the complex interactions between biophysical changes and changes in human systems; the gendered dimensions of Arctic change; Arctic settlements, cities, and communities; impacts of global change on Arctic cities and urban areas; Arctic institutional arrangements and questions on what types of institutions work best to improve the economic well-being of northern residents; and the promulgation and adoption of best practices, e.g., for evaluating the impact of economic development initiatives in the Arctic and to calculate environmental, social, and cultural costs and benefits (Larsen and Fondahl 2014).

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Commentary

Alexander Klepikov, Alexander Danilov, and Genrikh Alekseev

Ongoing climate change is a matter of a serious concern in Russia, since its impact on natural and economic systems as well as on humans is becoming more and more evident. Internationally, the need for urgent and effective measures aimed at mitigation of impacts of economic activities on the Earth's climate system and adaptation to climate change is now widely recognized (Roshydromet 2014).

The Russian Federation has adopted a climate policy that calls for assessment of socioeconomic impacts of climate change on the federal level. The document is a political declaration determining the main direction for the development of legal, economic, and other tools that can protect the state, the economy, and society against unfavorable consequences of climate change and open the door for benefiting from potentially favorable climate change consequences.

At the United Nations Summit on Climate in New York in 2014, Presidential Adviser and Special Presidential Envoy on Climate Change Alexander Bedritsky said that in recent years Russia has actively participated in international climate cooperation, and that Russia is the world leader in terms of the volume of reductions of emissions. Cumulative emissions reductions in the energy sector in Russia over the past twenty years are equal to five years of emissions from the European Union or three years of emission from the United States. Due to the policy of structural optimization and energy saving for the period 1990–2011, carbon intensity of Russia's gross domestic product (GDP) fell three times. Current Russian state policy is focused on low-carbon development.

At the international conference on Problems of Adaptation to Climate Change (PACC, Moscow, November 2011), Alexander Frolov, the head of the Federal Service for Hydrometeorology and Environmental Monitoring of Russia (Roshydromet), noted that "global warming is unequivocal and there is a high probability that it will be escalating in future. Climate change impacts on natural and economic systems and people living in different regions across the world are diverse and often negative. Although for some regions, and a part of the Russian territory among them, climate change may bring not only losses, but certain potential benefits."

The greatest threat to sustainable development associated with climate change is posed by extreme weather and climate events. Increased frequency and intensity of extreme events are seen in many countries, and scientific projections indicate that droughts, heat waves, and floods in various regions will grow both in the short and long term. The heat wave over Russia in the summer of 2010 caused overall losses of more than 250 billion rubles in the Russian economy. The problem of adaptation to climate change is especially acute in northern latitudes, with stronger manifestation of global warming effects as compared to other regions in the world. Changes in permafrost, which is present in more than 60 percent of the territory of Russia, have already had a noticeable impact on the state of ecosystems and, in particular, are reducing the ground bearing capacity (Frolov 2011).

The Arctic is highly important for Russia in the twenty-first century. Unlike the Soviet Union, Russia is in a sub-Arctic nation. Russian Arctic territories are really vast, even in comparison with the other Arctic states. Two thirds of the circumpolar wealth is created in the Russian Arctic (Pelyasov 2013). Enormous natural resources of the Arctic region enhance its significance even more. An extensive sea boundary and a vast offshore zone with substantial reserves of hydrocarbons determine the specifics of the problems of the Russian Arctic.

A strategy of development of the Arctic zone and national security of the Russian Federation for the period up to 2020 was approved by the president of the Russian Federation in February 2013. The whole document is concerned with the internal problems of the Russian Arctic and much less with international affairs. The Russian Arctic has a large scale of industrial activity in comparison with the other Arctic states. Here we have the most urbanized Arctic populations in the world, the maximum amount of single-industry cities and settlements, and the most powerful resource sector of the Arctic economy. Not surprisingly, then, the imperative of innovative modernization is emphasized throughout the whole text of the strategy. Large-scale industrial activity began in the Russian Arctic decades before the other polar countries (Pelyasov 2013).

Environmental safety is covered in the document in several instances. These include the realization of projects to redress environmental damages coming from past industrial, military, and other activities. The elaboration and realization of measures to diminish environmental risks is also connected with the expansion of industrial activity including the Arctic shelf. This includes the utilization of special datasets to control the situation and minimize pollution and the development of renovated land- and space-based monitoring systems. It also seeks to address the consequences of global climate changes in the Russian Arctic zone, taking into consideration biodiversity of the Arctic flora and fauna, dangerous situations, etc. Additionally, it describes the development and expansion of the network of the protected federal and regional Arctic natural reserves (Pelyasov 2013).

Climate change has become an important problem in the Russian Arctic in the past decades. Climate change consequences including damage to infrastructure of pipelines, formation of spring ice jams, destruction of buildings, and transitions to new agricultural crops all require development of adaptation strategies. If no measures are undertaken, then climate change may create a threat to existence of the peoples of the north, especially in combination with socioeconomic tensions. The indigenous peoples should play a key role in the development of strategies to mitigate adverse impacts.

The Arctic is extremely vulnerable to climate change. The region is warming much more rapidly than the global average. The Intergovernmental Panel on Climate Change (IPCC) report states that the winter warming of northern high latitude regions by the end of the century will be at least 40 percent greater than the global mean, based on a number of models and emissions scenarios. Temperature increases for the central Arctic are projected to be about 3°–4° Celsius during the next fifty years. Even an optimistic scenario for projecting future greenhouse gas emissions yields a result of a 4°C increase in autumn and winter average temperatures in the Arctic by the end of this century (US NIC 2009).

A detailed assessment of climate change impact, presented in the Arctic Council's *Arctic Climate Impact Assessment* (ACIA) report and the Arctic Monitoring and Assessment Programme's *Snow, Water, Ice, and Permafrost in the Arctic* (SWIPA) report, will allow the population of the northern territories of Russia to better adapt to the consequences of climatic changes and give proposals to the federal and regional authorities on adaptation strategies, adaptation of local economic activity to climate changes, and preservation of biodiversity.

In 2008 Roshydromet, together with the Russian Academy of Sciences and the Universities, issued the *First Assessment Report on Climate Change and Its Consequences in the Russian Federation* (Roshydromet 2008). The report predicted considerable reduction in ice-covered area in the Arctic that will continue during the twenty-first century. The maximum sea ice extent, which is normally observed in March, will continue to decrease by 2 percent per decade, and the minimum sea ice extent, which normally happens in September, will be reduced by 7 percent per decade relative to ice extent for the period 1910–59, with a faster reduction in the area of multiyear ice in comparison with the seasonal ice area. At the end of the twentieth century the habitat of polar bears decreased significantly as a result of reduction in sea ice cover. In the twenty-first century, as a result of further warming, the overall tendency will be the reduction of ice cover in the northern seas, although some periods of increase and decrease at the regional scale may occur. An increase in iceberg occurrence is possible during periods of warming, as well as degradation of the land-fast ice and erosion of the coastline (Roshydromet 2008).

The *Second Roshydromet Assessment Report on Climate Change and its Consequences in Russian Federation* has been published recently (Roshydromet 2014). Similarly to the *First Assessment Report*, the new one is based on peer-reviewed journals and scientific monographs, proceedings of scientific conferences, and special scientific reports published upon decisions of scientific editorial councils and boards. Observational data from the federal observing network of Roshydromet as well as from scientific projects implemented under various international and national research programs were widely used in the report. The report is intended primarily for policy makers who develop and implement national climate policy and programs on sustainable development of territories and regions of the country.

The *Second Assessment Report* includes a consideration of the impacts of climate change on shipping, offshore business activities, and marine biological resources in the Russian part of the Arctic Ocean. During the last decade, the Arctic climate changed at an unprecedented rate. Climate warming and sea ice shrinking provides free access to the Arctic and increases the interest in the Arctic region due to the large reserves of oil, gas, and mineral resources, as well as new opportunities for trans-Arctic shipping and for fisheries. The most impressive response to the evolving global warming at the regional scale is a decrease in the extent and depth of sea ice in the Arctic. Future ice conditions along the Northern Sea Route (the Northeast Passage) are important for designing new transport and ice-breaking ships, choosing new navigable passages, and keeping control by Russia over shipping in the economic zone. Conditions for the navigation in

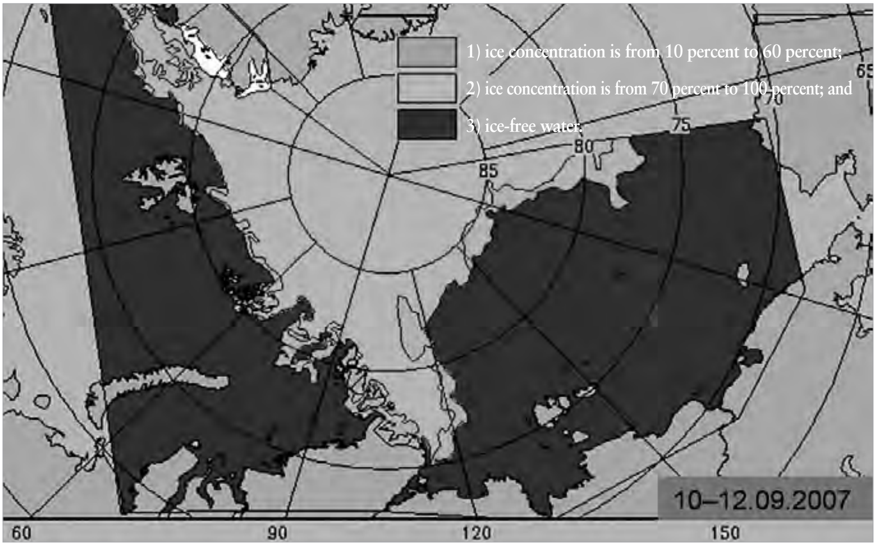

Figure II.16 The Taymyr Sea Ice Massif (aggregation of ice with concentration of 90 percent to 100 percent, extending from the Central Arctic along Severnaya Zemlya to the coast of Taymyr) blocked the Northern Sea Route near the Strait of Vilkitsky even in September 2007, when sea ice in the Arctic reached a record low extent. Sea ice map for 10–12 September 2007 (http:/www.aari.ru/projects/ESIMO/index.php).

high latitudes will become more favorable and year-round Arctic navigation routes may be opened. At the same time, since sea ice remains during some periods of the year and complicated ice conditions may occur (figure II.16), the Russian ice-breaker fleet should be maintained and further developed (Roshydromet 2014).

Difficult environmental and climatic conditions of the Arctic shelf give rise to serious marine infrastructure risks and increase the cost of business projects. Particularly serious risks relate to ice phenomena: ice compression; impacts of large ice sheets, icebergs, ridges, and hummocks; ice gouging; early ice cover formation, etc. Additional risks may arise due to coastline erosion and permafrost degradation.

Under the ongoing warming in the Arctic, it is recommended to make projections taking into account all the risks mentioned above and to include the relevant recommendations into the environment-related regulatory documents to be used in the Arctic-shelf development projects.

Current knowledge is not sufficient to determine clearly the consequences of climate change for productivity of commercial-fishery species and their feeding resources. In general, marine systems are adapted to variability of environmental conditions. Therefore, the situation in the fishery sector depends primarily on catch volumes, including overfishing of valuable species (Roshydromet 2014).

A basic document determining the international legal regime of sea and ocean areas, including the Arctic Ocean, is the United Nations Convention on the Law of the Sea ratified by the overwhelming majority of states. In Article 234 of the convention, maritime transport activities in the high-latitude economic zones are directly linked with ice cover. This article specially emphasizes the "ice-covered regions" (where ice is observed for more than six months of the year), where it is possible to expand the prerogatives of the coastal states. The specifics of the Russian rules of navigation along the Northern Sea Route are based exactly on these provisions.

The boundary of the economic zone and the outer limits of the continental shelf of Russia are measured from the coastline. The longer ice-free period combined with increased wind and wave activity and temperature rise will accelerate the coastline retreat to several kilometers per century. In the exclusive economic zone, the coastal state has sovereign rights for the purpose of exploring and exploiting, conserving, and managing the natural resources, whether living or nonliving, of the waters superjacent to the sea-bed and of the sea-bed and its subsoil. If ice conditions become more favorable, the resource-related interests of other states may expand only into areas outside the exclusive economic zone and the continental shelf of the coastal state. Projections of changes in ice conditions for the twenty-first century show that ice cover will remain in the passages of the Northern Sea Route for more than six months in a year. Russia can use these projections as a basis for regulation of shipping in its Arctic exclusive economic zone (Roshydromet 2014).

It should be noted that the uncertainty remaining in the estimates of future climate is just a small part of the uncertainty regarding possible developments of the regional economic system. The Arctic warming observed currently and further expected in the twenty-first century is generally beneficial for maritime economic activities including shipping and hydrocarbon production on the shelf. Adaptation to some consequences of climate change is needed, for instance to adverse meteorological conditions (more storms in an ice-free area, increased impact of waves, increased spray freezing, etc.). New standards should also be developed for construction of coastal engineering structures, particularly in places where coastline erosion and permafrost degradation take place.

To implement the strategy of development of the Arctic zone of the Russian Federation, international cooperation is important. In the international area the United Nations Environment Programme/Global Environment Facility (UNEP/GEF) and the Arctic Council play the most important roles.

A Strategic Action Program for Protection of the Russian Arctic Environment (SAP-Arctic) was approved by the Maritime Board of the Government of the Russian Federation in June 2009. This document was developed by the Ministry for Economic Development of the Russian Federation on a basis of materials produced by the UNEP/GEF Project "Russian Federation—Support to the National Program of Action for the Protection of the Arctic Marine Environment."

The Strategic Action Program for Protection of the Russian Arctic Environment calls for preserving and protecting the Arctic environment and eliminating negative environmental impacts from economic and other activities. SAP-Arctic was developed in accordance with the Constitution of the Russian Federation, federal laws, and other regulations of the Russian Federation. It conforms to accepted principles and rules of international law, while taking into consideration domestic and international practices of environmental protection. It defines the principles, goals, objectives, and main activities to ensure protection of the environment in the Arctic region of the Russian Federation, considering the region's growing importance in the regional and global context.

SAP-Arctic is a framework document the provisions of which are to be taken into account when drafting governmental, federal, regional, and corporate programs for the development of industrial and other processes in the Russian Arctic. The scope of SAP-Arctic is the Russian Arctic, including the Komi Republic and the Khanty-Mansiysky Autonomous District, where pollution sources have a substantial impact on the Arctic environment (SAP-Arctic 2011).

The proposed objective of the GEF-Russian Federation Partnership on Sustainable Environmental Management in the Arctic under a Rapidly Changing Climate (Arctic Agenda 2020) is to accelerate the implementation of transboundary pollution reduction and control, biodiversity conservation including marine biodiversity and fisheries, use of alternative sources of energy and reduction of greenhouse gas (GHGs) and black carbon emissions, and climate adaptation measures in most vulnerable sectors of the Russian Arctic. The proposed initiative will make a transformative impact on environmental governance in the region by providing a platform for delivering the local, regional, and global environmental benefits in an integrated way that will help to achieve the SAP-Arctic targets and make a significant contribution to sustainable development in the region.

Creation and expanding public-private partnerships on environmental rehabilitation of hot spots in the Russian Arctic constitute a key feature of the Arctic Agenda 2020. Being based on partnerships with regional and municipal authorities established during implementation of SAP-Arctic, the Arctic Agenda 2020 aims to facilitate proactive engagement of the largest Russian industrial and energy companies—such as Gazprom, Rosneft, Lukoil, and Norilsk Nikel—as well as Russian financial institutions in protecting the Arctic environment. The proposed strategic approach envisaged attraction of financial resources and expertise from the World Bank, European Bank for Reconstruction and Development (EBRD), Nordic Investment Bank (NIB), Nordic Environment Finance Corporation (NEFCO), and other international financial institutions to address existing barriers in a systematic way and to strengthen and sustain the platform for environmentally and socially sustainable development in this globally significant region of the world. This corresponds to interests of the Russian Federation and those of the neighboring Arctic countries. Projects under the Arctic Agenda 2020 are:

- improvement of environmental governance and knowledge management for SAP-Arctic implementation;
- financial mechanisms of environmental rehabilitation in the Russian Arctic;
- conserving biodiversity in a changing Arctic;
- integrated river basin management for major Arctic rivers to achieve comprehensive benefits;
- integrated adaptive management of the West Bering Sea Large Marine Ecosystem in a changing climate; and
- targeted support for energy-efficiency and renewable energy in the Russian Arctic.

The first project includes a three-component technology-needs assessment and technology transfer pilots simultaneously reducing GHG and short-lived climate forcers (SLCFs).

Other areas of international cooperation in the Arctic Russia are connected with the working groups of the Arctic Council in which Russia participates actively. Russia pays great attention to the Arctic Council's Scientific Cooperation Task Force (SCTF). This group is working on an agreement on international scientific cooperation in the Arctic to contribute to and build upon existing cooperation and make efforts to develop and expand international scientific cooperation in the Arctic. Russia prepared the following research priorities in the Arctic for the discussion at the SCTF meetings:

- long-term monitoring of changes in the Arctic based on standard technologies and the development of modern observational facilities and integrated systems for the meteorological, oceanographic, hydrological, cryospheric, biological, ecological, socioeconomic, and other observations, including the maintenance of simultaneous and comparable observations;
- creation of a united multidisciplinary information facility for environmental and socioeconomic studies using a distributed database model, including the unified standards for description and representation of data;
- development of new information and communication technologies and organization of the collection and exchange of data, including the international exchange and development of data assimilation, as well as the preparation of various information products to serve the needs of society and to be made available for broad public use primarily through Internet portals;
- study of large-scale and regional changes in the Arctic climate system and the environment, and their role in global climate processes;
- assessment of the impacts of climate change in the Arctic zone of the Russian Federation under the influence of natural and anthropogenic drivers, and the medium- and long-term projections of the Arctic climate;
- study of short-term hazards (storm surges, ice storms, extreme ice drift, floods, etc.) and unfavorable long-term changes (sea level rise, the degradation of the coastline, the thawing of permafrost, iceberg calving and distribution, etc.) to implement measures to ensure the safety of the population and lands that are subject to the most severe

impacts of the climate related events;

- assessment of the state of the environment of the Arctic region, including the assessment of persistent organic pollutants, heavy metals, and radioactivity, as well as study of the effect of black carbon and other short-lived climate pollutants on climate change. Oceanographic research, including the variability of sea ice, distribution of Atlantic water in the Arctic Ocean, and acidification of the Arctic Ocean;
- study of the hydrological regime of the rivers and lakes, including changes in river runoff and freshwater balance of the Arctic;
- reconstruction of paleoclimatic changes as a basis for understanding the potential limits and the rates of current climate change;
- space weather studies in the Arctic magnetosphere and ionosphere, including the impact of cosmic rays on communication systems and humans;
- research on the impacts of climate change on marine and terrestrial ecosystems, fisheries, transport systems, infrastructure, and other sectors of economic activities in the Arctic;
- study of the effects on human health of Arctic environmental changes and hazards, including those related to climate change and pollution;
- investigation of the mechanisms of adaptation to climate change in the Arctic; and
- improving the educational and scientific potential for Arctic research and dissemination of knowledge among the broad public.

At the SCTF meetings, Russia promotes the idea of the International Polar Partnership Initiative (IPPI). This is because the IPPI is the continuation and development of the International Polar Year (IPY) organized by World Meteorological Organization (WMO) and International Council for Science (ICSU) in 2007–08. IPY 2007–08 was important for Russian polar research. During the period of IPY 2007–08, Russian polar researchers received approximately USD 27 million additional funding support. These additional funds were spent primarily on fieldwork and the development of observational infrastructure in the Russian Arctic and on support for specific Arctic expeditions. More than eighty scientific and public organizations of different ministries took part. A total of 159 marine and land expeditions were carried out by Russia in the Arctic and the Antarctic (48 expeditions in the Arctic in 2007 and 63 in 2008). More than 200 scientific projects were implemented (75 percent in the Arctic, 10 percent in the Antarctic, and 15 percent as bipolar projects). Activities included studies of the environment, climate and paleoclimate, atmosphere, ocean, cryosphere, lithosphere, near-earth space, and ecosystems of the polar regions.

The efficiency of adaptation strategies can be increased by means of further studies of potential impacts of climate change. These studies can be coordinated within the framework of the IPPI. The main topics of the IPPI include optimization and development of the observation systems for polar regions, achieving increased predictive capabilities for weather and climate in the polar regions, integration of new understanding of natural processes into the daily use and culture of the peoples of the north to improve the conditions of their existence, and conservation of polar ecosystems. Scientific studies under the aegis of IPPI should correspond to the requirements of the world community and are intended to provide more reliable data for decision making with respect to adaptation to climate change in the Arctic.

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Commentary

Sung Jin Kim

PREFACE

Climate change is the most important challenge facing the international community. Since the 1980s, global warming has engaged attention all over the world. In particular, the Intergovernmental Panel on Climate Change (IPCC), established by the United Nations in 1988, has been playing a significant role in evaluating and providing warning regarding the risks of human-caused climate change. Since its inception, the IPCC has published five climate change assessment reports, in which climatologists clearly conclude that climate change has already begun. These reports predict that the sea level will rise by 98 cm from the current level due to climate change by 2100. Most scientists attribute climate change to the effects of global warming whose biggest cause is the emission of carbon dioxide (CO_2) into the atmosphere. The main point of the reports is that it is urgent that we reduce greenhouse gas emissions. Certainly, all changes, in particular sea level rise, cannot be attributed to global warming alone, and there are groups of scientists skeptical of the commonly held view that sea level rise is the result of interactions among marine, geological, and geophysical factors. Nevertheless, the influence of global warming on sea level rise cannot be underestimated, and the fact remains that existing perceptions that the climate is changing due to human activities and that the warming of the Earth's climate system is a fact are central to much climate change debate and discussions.

The United Nations-led effort to encourage global participation and cooperation in the reduction of greenhouse gas emissions so far has fallen short of expectations. However, a number of developing and developed countries, including many of those in Europe, have been leading the way in the effort combat climate change. More recently, the United States and China, the largest emitters in the world that had previously ignored calls by the international community to join in the global effort, have expressed their will and desire to reverse their former stance and actively participate in the global fight against climate change.

Korea was categorized as a Non-Annex I country under the Kyoto

Protocol in 1997. But twenty years later, it has become one of the industrially advanced economies with the world's seventh largest per capita CO_2 emissions. Korea, having won the bid to host the Green Climate Fund (GCF), which is a global financial institution founded by the United Nations Framework Convention on Climate Change (UNFCCC) to support developing countries with their greenhouse gas reduction and adaptation activities, in Song-do, Incheon, in 2012 is in a position to initiate and lead practices to reduce global greenhouse gas emissions.

In the following sections, I give an overall comment on the presentation by Armstrong, an introduction to Korea's policy direction on climate change, and, finally, my opinion regarding Armstrong's views and arguments.

SHORT COMMENT ON THE PRESENTATION

General Overview

The Arctic region is where the impacts of global climate change are more apparent. According to a report of a working group of the United Nations, the Ad Hoc Working Group of the Whole on the Regular Process for Global Reporting and Assessment of the State of the Marine Environment, including Socioeconomic Aspects, entitled *The First Global Integrated Marine Assessment*, issued on 22 July 2015, "in the past 100 years, average Arctic temperature has increased at almost twice the average global rate." The report also pointed out that "reduced sea ice, especially a shift towards less multi-year sea ice, will affect a wide range of species in those waters."

Today, due to Arctic warming, the Arctic Ocean and its ecosystems are undergoing significant changes. However, since addressing climate change will require not just a region-wide effort but a global one, it will be necessary to adopt a multi-layered approach in addressing this issue. That is, when providing solutions for climate change in the Arctic, taking short- and long-run perspectives that reflect the special circumstances of the Arctic region, scientific knowledge and a comprehension of available information will be necessary. In particular, institutional systems such as national and international legislation, executive orders, and multilateral agreements will be important. In this regard, Armstrong's brief and precise presentation on "Climate Change: Mitigating Arctic Impacts and Adapting to Changed

Conditions" contains much information that deserves due consideration.

Major Impacts and Actions

Armstrong presents five major impacts of Arctic climate change: sea level rise, Arctic sea ice loss, weather extremes, ocean acidification, and thawing permafrost. These five impacts have their respective features, which are as follows.

Sea level rise has graver consequences for low-lying countries and coastal areas, such as the delta region of Bangladesh and small island Pacific states than for the Arctic region.

Melting of the Arctic ice and the opening up of the sea for shipping and resource development will bring about increased economic activity in the region. This is the main reason why Arctic littoral states are competing to assert their claims in the Arctic and non-Arctic, states including China, Japan, and Korea, are interested in the area as well. Expanded passage to shipping and tourism will also have implications for maritime safety and security.

Weather extremes and ocean acidification are phenomena that occur not just in the Arctic but globally. Lastly, thawing permafrost could accelerate human economic activities on the land of the Arctic region as is the case with melting Arctic sea ice. Although increases in human economic activity due to the melting Arctic ice and permafrost have some economic advantages, they can also accelerate adverse impacts due to climate change in the Arctic.

In his presentation, Armstrong focused on the effect of Arctic climate change on nature. That is the primary effect. However, I think it would also be meaningful to analyze the secondary effect. For example, we could consider changes in fish stocks due to the effects of climate change on the sea temperature and ocean currents and the resultant (positive and negative) effects on the Arctic environment and economic systems as well as on the changes in the indigenous peoples' livelihoods.

After a detailed explanation on the five Arctic climate change effects, Armstrong discussed how the problem should be approached from a governance perspective. More specifically, he proposed mitigation, adaptation, climate engineering, and suffering as four options based on scientific knowledge and information that could be chosen when making relevant political and policy decisions regarding climate change in the

Arctic. He made the assumption that a systematic governance mechanism for responding to climate change in the Arctic would require a combination of at least three of the four options, and he called this the "Science-Decision Cycle." The reason he suggested this model is, as he mentioned in his conclusion, to provide better information about all or parts of the Arctic region so that communities that need to make policy decisions about issues involving the rapidly changing Arctic can respond more effectively. This model, which emphasizes coordination between science and policy decisions, is specific and useful. But how this model can be applied to real cases will need to be worked out. In this respect, discussions about governance as a "collaborative-consultative process" at North Pacific Arctic Conferences (NPACs) in order to promote cooperation between Arctic and non-Arctic states regarding Arctic issues will be meaningful.

KOREAN EFFORTS AGAINST CLIMATE CHANGE

In response to these changes in conditions, the Korean government has gathered information about the scientific basis and effects of climate change and issues of adaptation as part of the *Korean Climate Change Assessment Report 2014* which was published in February 2015.

This report mainly is about recent study results conducted from 2010 up to now, since the *Korean Climate Change Assessment Report 2010* was published in 2011. The report contains information on the past, present, and future of climate change on the Korean peninsula and the East Asian region based on IPCC reports. Based on an assessment of various experts' opinion and scientific analytical results, the report examines and analyzes new evidence of climate change, thereby increasing the confidence of the report.

The main point of this report reaffirmed the core message of the *Fifth Assessment Report* (WG I) of the United Nations Intergovernmental Panel on Climate Change (IPCC, AR5), that the warming of the climate system and climatic change due to human activities is clear.

In addition, the Korean government announced a greenhouse gas emissions reduction goal of 37 percent relative to "business as usual" (BAU) by 2030 in line with the post-2020 climate system. The government explained that the reduction target for Korea was set higher in the hopes that through reduction efforts new opportunities in the energy sector will be created as well as to reflect the fact that Korea has been among countries leading the effort against climate change in the international community.

Meanwhile, an agreement on the new climate system based on intended nationally determined contributions (INDCs) submitted by individual countries is expected at the United Nations Framework Convention on Climate Change (UNFCCC) Conference of Parties to be held in Paris in December 2015.[1] Korea is planning to formulate reduction targets by sector, industry, and yearly bases; establish and implement measures to support certain industries; and improve laws and regulations after a national reduction goal is publicly announced after the Paris Climate Conference.

Nongovernmental organizations (NGOs) expressed their disappointment that the government was not doing enough and demanded that Korea meet the expectations of the international community by setting a higher reduction target. On the other hand, industry criticizes the reduction target as excessive and unrealistic. In particular, they expressed concern that an excessive reduction target could weaken Korea's industrial competitiveness and result in a sluggish national economy with low economic growth rates.

From an objective point of view, the underlying reason for the European Union's active involvement in the effort against climate change is the belief that reducing greenhouse gases will provide an opportunity for innovative thinking rather than becoming a burden on the economy. In fact, during the past twenty-two years the gross domestic product (GDP) of the European Union increased by 44 percent while its greenhouse gas emissions fell by 20 percent.

Finding an effective policy response against climate change is difficult within a short period of time, and it is only possible when the formulation of mid- to long-term planning is supported with large investments. Now, we have come to a point where we need a proactive and new approach in addressing climate change, with the perception that climate change is no longer a burden on the economy but rather an opportunity to create a new growth engine.

As far as most states share concerns on the seriousness of climate change, it is expected that there will be a stronger push for the new United Nations climate system than for previous arrangements. An active will, response, and action, rather than a thousand words, is all that is needed to turn reduction efforts of green gas emissions into a chance for growth.

EFFECTIVE RESPONSE MEASURES AGAINST CLIMATE CHANGE

In the following, I would like briefly to present my personal opinion on effective responses to climate change in the Arctic.

Causes of Climate Change (Global Warming) and the Classification of their Impacts

Armstrong summarized five major impacts of Arctic climate change. Here, we need to distinguish the causes of climate change from their consequential effects. Although there is some disagreement, the main cause of climate change is global warming caused by excessive emission of CO_2 into the atmosphere. Even though there are some exceptions, such as the acceleration in the effort to replace fossil fuels in some advanced countries such as those of northern Europe, global warming is increasing due to human activities and industrialization. Although climate change is caused by universal human activities, its consequences will be felt globally, through sea level rise or abnormal climatic events, and regionally, through melting Arctic ice and thawing of permafrost. Accordingly, addressing climate change in the Arctic will require efforts at the global level to remove the causes of climate change along with simultaneous efforts to adapt to its regional impacts. Regarding the former, the international community has been working on reducing CO_2 emissions since 1997 with the adoption of the Kyoto Protocol. However, it is not easy to produce an effective solution due to conflicting interests among countries. Although there are increasing efforts to reduce the use of fossil fuels with the development of technology through the use of electric cars and solar or wind power, these efforts are not enough to eliminate the causes of climate change.

Since there is little progress in the development of fundamental measures against the cause of climate change, there are also limits to the effort to mitigate or reduce its impact. Nonetheless, given that rising sea level is eroding coastal areas, displacing people from their homes, and threatening the existence of small island states in the Pacific, measures to respond to these issues will be needed in addition to efforts to address causes of climate change. Such response measures usually consist of merely building breakwaters along coastlines, relocating coastal residents to the uplands, and Law of the Sea discussions on the scope of maritime jurisdiction in accordance with changed baselines. Meanwhile, thawing sea ice in the Arctic has given rise to changes in the Arctic ecosystem which are leading to the loss of polar bear habitats, exploitation of natural resources in the region, and transition of indigenous peoples' way of life. Therefore, the main contents of response measures against such impacts are focused on minimizing the negative consequences and supporting adaptation to the changed environment. As can be seen, efforts to alleviate the influence of the abnormal climate change are hardly more than disaster countermeasures or emergency responses. Without a fundamental solution to the causes of climate change, there cannot be effective countermeasures to its impacts. Accordingly, in order to address Arctic climate change, simultaneous actions are required on its causes as well as impacts.

Recognizing Uncertainty and the Limitations of Scientific Research

The overall scientific and technological advancement in the twenty-first century has been remarkable. Also, results from the study of causes and impacts of climate change by scientists have accumulated for decades. However, in examining the effects of climate change and formulating response measures, we need to acknowledge that the science we have is not complete. For example, predictions based on existing scientific data on what could happen twenty, thirty, or fifty years down the road show great variations. This is why the predicted dates for complete melting of the Arctic ice or the predicted rise in sea level are all different, which can only confound policy makers who need to come up with measures based on scientific information. As such, more open fora for active communications and exchanges among Arctic scientists and policymakers would be desirable.

The Ocean: A Problem Solver, as Opposed to a Victim, of Climate Change

As shown in Armstrong's presentation, impacts of climate change such as sea level rise and thawing sea ice in the Arctic have direct impact on the ocean. However, current research on climate change indicates that the ocean could possibly play a role as a climate change problem solver. In fact, the ocean is the biggest storage system for CO_2 on Earth. Since CO_2 naturally moves from the ocean surface to the deep seabed through ocean circulation, bringing more quantity of CO_2 into the deep seabed can be an option in mitigating climate change. Marine geoengineering, one of subcategories of climate geoengineering, conducts research on these issues.

A recent field of research on addressing climate change through the reduction of greenhouse gas emissions is called "climate geoengineering." Climate geoengineering deliberately and extensively intervenes in the Earth's climate system to alleviate global warming caused by the emissions of greenhouse gases from fossil fuels. It is divided into research that looks into the capture, storage, and absorption of CO_2, a major type of greenhouse gas, and research on the release of thermal energy from the atmosphere into the outer space. Marine geoengineering, a subcategory of climate geoengineering, is "the deliberate intervention in the marine environment to manipulate natural processes, including to counteract anthropogenic climate change and/or its impacts." Accordingly, further development of marine geoengineering is required so as to resolve climate change and the Arctic warming problems through the ocean.

Given that marine geoengineering is a relatively new field, it is surprising that some research of his type has already been incorporated into an international treaty, considering that legal norms are passive by nature and in general adapt to the outcomes of scientific research slowly. In this regard, identifying the incorporated types of research will help in coming up with measures against Arctic climate change.

The aforementioned international treaty is the 1996 Protocol to the 1972 London Convention; its purpose is to prevent marine pollution by prohibiting dumping of wastes and other matter from ships and aircraft, thereby protecting and preserving the marine environment. In 2006, parties to the protocol adopted an amendment that added "carbon capture and sequestration (CCS)" to the list of possibly acceptable wastes for dumping, the so-called "reverse list." Although CCS, a part of marine geoengineering that has recently gained attention, reduces CO_2 going into the air and consequently mitigates climate change caused by global warming, the reason why the London Protocol regulates CCS is that the technique itself may cause pollution of the marine environment which would then amount to "dumping" under the protocol. In other words, the London Protocol only allows such actions of marine geoengineering after a set of procedures is followed.

At the meeting of contracting parties in October 2013, another marine geoengineering activity, namely ocean fertilization, was incorporated into the protocol. Ocean fertilization refers to any activity undertaken with the principal intention of stimulating primary productivity in the oceans (resolution LC-LP.1, 2008) by adding nutrient salts, mainly iron or nitrogen, to the ocean or extracting them from the deep sea. Through this process, plankton in the ocean become more active and consume more CO_2. Accordingly, CO_2 in the air moves into the ocean, thereby reducing the concentration of CO_2 in the air. However, there are also arguments that the effect of such measures in reducing the level of CO_2 in the air is minimal and that it would only pollute the marine environment. Taking into account these concerns, the London Protocol only allows "legal scientific research" that has obtained permits from the contracting parties under strict conditions. This is the result of a strict application of the environmental precautionary principle, in a situation where the impacts of ocean fertilization on the marine environment are unknown. Research on ocean fertilization is still in a nascent stage, with only thirteen experiments conducted so far.

However, what is notable about the London Protocol, which aims to protect and conserve the marine environment by regulating waste disposal at sea, is that it includes regulations on activities that are directly linked to climate change and those concerning scientific methodologies at an early development stage. While the protocol was created to minimize the impacts of carbon capture and sequestration and of ocean fertilization on the marine environment, marine geoengineering activities, which could possibly be fundamental solutions to climate change, should be developed continuously and provided with institutional support.

Importance of Cooperation via Knowledge and Information Sharing

Armstrong emphasized cooperation among stake-holders so that knowledge and information generated from scientific research can be easily conveyed to policy makers with various levels of knowledge. This kind of cooperation to share information and knowledge among scientists, states, international organizations, and research institutions is imperative, given that the unique geopolitical environment of the Arctic makes it difficult to conduct scientific research in the region. However, there is limited cooperation of this sort at the moment. Information is generally obtained through the published work of Arctic Council's working groups, from various international conferences on the Arctic, and from websites of relevant institutes. However, there is no forum that facilitates exchange of Arctic information and knowledge.

In this regard, the Korea Maritime Institute (KMI) made a meaningful attempt at promoting inter-institutional cooperation on information exchange last July. Various Arctic-related research institutes gathered at KMI and shared their experience in operating an Arctic information portal service and discussed how cooperation through information sharing can be continued and expanded. The continuation and development of such meetings will be the next important step so that information networking among scholars and research institutions is created and the sharing of information is accomplished easily. When this is achieved, an easy process of coordination and cooperation on policies and projects may follow.

Discussion on Specific Cooperation for "Climate Change: Mitigating Arctic Impacts and Adapting to Changed Conditions"

Armstrong's intention to discuss how to alleviate impacts of climate change and support adaptation to the inevitably changed Arctic environment can be inferred from the title of his presentation. The only thing I would like to point out is that the presentation does not discuss how to adapt to a changed environment. As shown well in the paper, the most dramatic environmental change is occurring due to Arctic climate change. As mentioned earlier, secondary effects will accordingly be felt by the flora and fauna, marine ecosystems, and the local residents. There is a need to eliminate the causes of the Arctic climate change and to minimize its impact, but there should also be a discussion of cooperation at the international and regional level in order to enable humans and animals to adapt well to the changed environment. This discussion could, of course, be taken up in the information and knowledge sharing network that was mentioned above.

CONCLUSION

The climate has been vital to pursuing human economic activities. In particular, when agriculture was the main industry for the country, climate change was directly linked to the nation's economy. An examination of various reports on global warming will show that they mostly discuss the negative aspects of climate change. Reporting on the seriousness of the warming of the Earth is important but, in comparison, discussions on the need for technical measures and of their possibilities are lacking. Perhaps the development of technology that is meant to improve energy efficiency will also further improve productivity, despite a reduction in greenhouse gases. Similar effects are expected for new and renewable energies. Following up on these technological measures will not only help maintain domestic productivity but also give impetus to economic growth.

The most feasible and effective effort would be to find scientific tools that will help establish the causes of climate change and reduce greenhouse gases. To respond to challenges faced by us all, there must be a promotion of vigorous scientific activities. Furthermore, I believe providing various fora for communication among scientists, interested states of the Arctic, and regional and indigenous groups will set a good example of the "collaborative-consultative process." In that regard, NPAC would be able to take on a facilitating role, and Korea, led by KMI, is also ready to take on a leading role.

Notes

1. The Paris meeting produced the Paris Agreement on Climate Change concluded on 12 December 2015 and opened for signature in April 2016.

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PART III

IMPLEMENTION OF THE POLAR CODE

Perspective

Lawson W. Brigham

INTRODUCTION

In May 2015, the International Maritime Organization (IMO) approved the final elements of a new Polar Code for ships operating in polar waters. This was the conclusion of a process that began in 1993 with the meetings of an outside working group to IMO, led by Canada, which produced a draft Polar Code in 1998. The IMO initially developed a set of voluntary guidelines, the 2002 IMO *Guidelines for Ships Operating in Arctic Ice-Covered Waters*, followed in 2010 by the IMO *Guidelines for Ships Operating in Polar Waters*. The Arctic Council, in its *Arctic Marine Shipping Assessment (AMSA)* released in 2009, recommended the *mandatory application* of relevant parts of the voluntary guidelines through the augmentation of global IMO ship safety and pollution-prevention conventions.

The new Polar Code establishes binding or mandatory international standards for new and existing commercial carriers and passenger ships operating in Antarctic and Arctic waters (applied to all these type vessels 500 tons and larger). The Polar Code, at its core, addresses marine safety and environmental challenges for ships operating in remote conditions where marine infrastructure is limited and frequently nonexistent. The code is also directly related to the future protection of Arctic people and their traditional lifestyles, especially those who live in Arctic coastal communities. For the maritime industry, the IMO sought in the Polar Code to create a uniform, nondiscriminatory set of rules and regulations that will produce a level playing field for all marine operators. The marine insurance industry will be one of the immediate beneficiaries of the Polar Code as the international standards will allow better evaluation of the risks associated with polar operations.

The Polar Code is not a new IMO convention, but is a set of amendments to two existing IMO safety and environmental protection instruments: the International Convention for the Safety of Life at Sea (SOLAS) and the International Convention for the Prevention of Pollution from Ships (MARPOL). A new, separate convention might have taken many years to gain full ratification by the maritime states, and it was agreed that the Polar Code would be an extension to the rules and regulations in SOLAS and MARPOL applicable to specialized polar ships. In summary, the Polar Code includes a range of new requirements for ships operating in polar waters:

- ship structural standards;
- marine safety equipment designed for operation in polar environments;
- training and experience of the ships officers and crew;
- Polar Ship Certificates issued by the flag states;
- onboard *Polar Water Operational Manual* (unique to a given ship and including operational capabilities and limitations); and
- environmental rules regarding the discharge of oil, noxious liquids, sewage, and garbage.

All maritime states have the challenge of implementing the Polar Code in their national legal and maritime regulatory systems following its entry into force on 1 January 2017.

APPLICATION OF THE POLAR CODE AND SHIP CATEGORIES

The boundary application for the Polar Code in the Southern Ocean is 60° South. This boundary around the Antarctic continent corresponds to the northern boundary of the Antarctic Treaty System. The boundary for the Polar Code's application in the Arctic is more complicated given the nature of the warmer waters in the North Atlantic and the advance of seasonal Arctic sea ice.

In the Bering Sea, the Polar Code boundary was established at 60° north so as to provide some measure of protection to the world-class fishery that exists in the region. This boundary also roughly corresponds to the seasonal maximum of winter sea ice in the Bering Sea (a seasonally ice-covered marine area much like the Baltic Sea). The boundary in the Atlantic moves slightly south to include all of Greenland and then runs northeast along the east Greenland coast and north of Iceland. It then continues until intersecting with the Russian Arctic coast in the Barents Sea. Thus, all of

Iceland, Norway, and Russia's Kola Peninsula are not considered within the Polar Code region, since they are normally ice-free year round.

Three ship-type categories were designated in the Polar Code in recognition that not all ships are intended for operation in the same ice conditions or even the same polar navigation season. The Polar Ship Certificate issued by the flag state will classify a ship for operation in polar waters in one of three categories:

- *Category A*—ships designed for operations in at least medium first-year ice which may include old ice inclusions (Polar Class 1 to 5 or equivalent, the highest ice-class ships).
- *Category B*—ships designed for operations in at least thin first-year ice which may include old ice inclusions (Polar Class 6 to 7 or equivalent, the lowest ice-class ships).
- *Category C*—ships designed for operations in open water or in ice conditions less severe than those in categories A and B.

A useful example of a category C ship would be a large passenger vessel that is not ice strengthened and that normally operates in open water. Such a ship could be operating in polar waters, perhaps along the west coast of Greenland in summer. A Polar Ship Certificate would be issued or approved by the flag state; this certification would include the polar ship category C and ice class (PC 1, most capable in ice, to PC 7, least capable in ice) if applicable; operational limitations; and, most importantly for a cruise ship, the required additional safety, communications, and navigation equipment. There would also be aboard a *Polar Water Operational Manual* that would include ship-specific information on this cruise vessel including operational capabilities and limitations. The requirement for a *Polar Water Operational Manual* was included so that shipowners and operators could have a practical guide to focus their attention on specific issues and challenges of voyaging in polar waters. It is very likely the ship classification societies will work closely with the flag states on the development of Polar Ship Certificates that will be uniform across the global maritime industry.

KEY CHALLENGES

Several key challenges await the full implementation of the Polar Code and subsequent administrative and enforcement aspects of this new, polar maritime regime. The commitment of the global shipping enterprise, flag states, marine insurers, and ship classification societies will be tested throughout the process of implementing this complex set of IMO specialized rules and regulations.

Looming Date and Tight Implementation Timeline

The Polar Code is due to enter into force on 1 January 2017. Final approval of all elements of the code came only in May 2015, so the maritime states have a significant challenge to implement the Polar Code in their national legal and (maritime) administrative systems in a relatively short period. Fortunately, the Polar Code is not a new and comprehensive convention, but a set of amendments to already existing IMO conventions. The requirements of SOLAS and MARPOL are well-known and well-refined, but the administrative challenges of the new Polar Code will add considerably to the workload of the flag-state maritime organizations. Not all current polar vessels will be issued Polar Ship Certificates by January 2017, so there could be an "administrative transition period" during the initial year of adjusting to the new code's broad regulations.

Marine Insurers and Ship Classification Societies

The roles of the marine insurance industry and ship classification societies will be vital to the successful implementation of the Polar Code by 1 January 2017. The new Polar Code provides both industries with a set of uniform (nondiscriminatory) international rules and regulations. The code can be considered a broad policy framework for enhancing polar marine safety and environmental protection that will be critical to the evaluation of future risks associated with polar marine operations. However, many of the technical details of the Polar Code (specifically those dealing with polar ship-construction standards) need to be developed by the individual classification societies and their representative body, the International Association of Classification Societies (IACS). The Polar Code requires each ship operating in polar waters to have a Polar Ship Certificate. The national maritime authorities of the flag states together with the ship classification societies must work closely together during the implementation phase so that the certificate process is ready for service to the industry by 1 January

2017. In addition, the Polar Code requires each polar ship to carry a *Polar Water Operational Manual* that is to be tailored for individual vessels. The development of the polar ship manuals will likely create a small service industry that will work closely with the ship classification societies and ship operators to meet these unique requirements of the code.

Commercial Passenger Vessel Requirements

The cruise ship industry, specifically companies operating large passenger ships that will be category C ships under the code, will have significant challenges to meet the higher standards of marine safety equipment, ship training, and mariner competency. Although these ships will not normally be operating in ice-covered waters (fully or even partially ice-covered), they will be operating in polar waters as defined by the code. It is unclear how many large passenger ships that have in the past operated, for example, off the west coast of Greenland and in the Antarctic will be modified to meet the higher safety standards of the code. It is plausible that only newly-built ships will be able to comply with the new marine safety, equipment, and personnel requirements for category C vessels. From the outset of the Polar Code development, more than two decades ago, it was recognized that a primary concern of the flag states has been the increasing number of large passenger ships voyaging in Antarctic and Arctic waters. The complete lack of infrastructure for emergency response and the minimal hydrographic data for modern charts in these polar areas poses significant challenges for a cruise ship industry intent on expanding in these remote and frontier regions. Even with the Polar Code coming into force, most of the marine infrastructure gaps remain and the operation of large cruise ships continues as a vexing issue for flag-state maritime administrations (who have their citizens aboard passenger vessels operating in Antarctic and Arctic waters during the short summer navigation seasons).

Experienced Polar Mariners

There are few fully qualified polar mariners in the global maritime workforce of 2015. It will take some time for the flag states to recruit and train a new cadre of mariners capable of operating safely in polar waters. Also, the requirements for mariner experience and mandatory training remain under development. There are several existing ice-navigation training centers (in Sweden, Russia, the United States, Canada, and Norway) but other flag states may also elect to develop their own training facilities in the decades ahead. It is highly likely ice/polar navigation training during the first decade of the Polar Code will be conducted in a handful of facilities operated by the Arctic states. In many respects, the human dimension of ships operating in polar waters is the most critical component of the Polar Code. Strict adherence to a new set of training and polar experience standards will be required for certification and licensing by the flag states. International cooperation, especially by the Arctic states (and Antarctic operators), will be necessary to close the wide gap in numbers of qualified officers and crew required for increasing polar marine operations.

Roles of the Arctic States

The Arctic states, through the adoption of the recommendations of the Arctic Council's *Arctic Marine Shipping Assessment (AMSA)* released in April 2009, affirmed their consensus that a mandatory IMO Polar Code was required as soon as feasible. Following *AMSA's* release, individual Arctic-state delegations to IMO, and the Arctic states in unison, helped to establish the process for development of a Polar Code in several IMO committees. Now that the Polar Code has been approved at IMO by consensus of the maritime state members, the Arctic states (and the Antarctic Treaty nations) share the challenges and responsibilities of providing visible proactive leadership during the code's implementation phase. The Arctic states, perhaps within the Arctic Council (now led by the United States as chair during 2015–17), should collectively articulate to the global community the importance and immediacy of implementing these new safety and environmental rules for polar ships. The United States has as its overall strategy during its Arctic Council Chairmanship "One Arctic: Shared Opportunities, Challenges and Responsibilities." One of three specific US themes is focused on "Arctic Ocean Safety, Security and Stewardship." Both of these laudable objectives lend themselves to enhancing the rapid and comprehensive implementation of the IMO Polar Code by all maritime nations. Within the Arctic, the Arctic states should cooperate and coordinate their implementation strategies so that the result is creation of a truly uniform regime. Such an action would mark the beginning of a process recommended in AMSA for uniformity of Arctic shipping governance and a possible harmonization of Arctic marine shipping regulatory regimes within their own areas of jurisdiction (consistent with the United Nations Convention of the Law of the Sea) and within the central Arctic Ocean. The IMO Polar Code is the *framework* for such uniformity and harmonization of existing national regimes.

Role of the Arctic States as European Union Members

The three Arctic states that are also members of the European Union (EU), have an added responsibility to articulate the urgency and importance of implementing the Polar Code as soon as possible to meet the tight deadline of 1 January 2017. Denmark, Finland, and Sweden, as EU members, must infuse a sense of critical importance in many of the (large) European maritime states for the full implementation of the Polar Code. The European Commission (EC) has observer status at IMO as an intergovernmental organization and the EC staff has participated in negotiating sessions for the SOLAS and MARPOL Polar Code amendments. None of the elements of the Polar Code should come as a surprise to the European Union and it is plausible that the European Union/EC will prod its membership to fully adopt and implement the code in their national systems.

Enforcement of the Polar Code

One of the first questions asked about the IMO Polar Code, especially by nongovernmental organizations (NGOs), is if it is possible to enforce the diverse elements of the code. The responsibility for enforcement falls primarily to the flag states and, in certain circumstances, to the port states. The marine insurance industry will have a lead role in insuring only ships that meet the new standards for ship construction and equipment and critical requirements for manning of these ships with trained and experienced personnel. The ship-classification societies will have a large role in certifying that polar class ships meet the new rules and important roles in advising the national maritime administrations of the technical details of the code. The new Polar Ship Certificate will likely play a central role in enforcement. If a ship sails north toward polar waters and reaches a port inside or outside the IMO Polar Code boundaries, the port-state officials could certainly make a request of the captain to see the vessel's Polar Ship

Certificate. Without an up-to-date certificate, the maritime authorities will not allow a voyage to continue into polar waters. The *Polar Water Operational Manual* will also be scrutinized by maritime law enforcement officers to see if the manual is ship specific focusing on the ship's systems operating in cold environments and the expertise of the ship's personnel to respond to a emergency event. The mandated certificate can quickly become a useful and influential vehicle for international enforcement of the code. The Arctic states with port-state control authority can feasibly become *regional gateways* for the control of ships entering the Arctic boundary of the Polar Code. The licensing and certification process for polar mariners by the flag states will also provide another layer for broad enforcement of the code. International lists of qualified polar mariners could be made available to the port states for identification and enforcement operations.

Monitoring and Tracking

The importance of ship monitoring and tracking of commercial ships voyaging and operating in remote polar waters is ever increasing. For all commercial carriers and passenger vessels subject to the Polar Code, each ship is required to have AIS (Automatic Identification System) equipment mandated by a 2002 IMO SOLAS agreement. The purpose is to have electronic identification of IMO classed ships (type and cargo) and continuous position, course, and speed information. Sharing this information among the Arctic (flag and port) states may require a new binding agreement that could be facilitated by the Arctic Council process (and signed by the Arctic states as they did for the Arctic Search and Rescue Agreement on Cooperation on Aeronautical and Maritime Search and Rescue in the Arctic and the Arctic Oil Spill Preparedness and Response Agreement). An alternative process would be for the Arctic-state maritime agencies to reach consensus on an operational agreement. Such a sharing of Arctic ship-traffic information (within the Polar Code boundaries) could provide valuable data on the effectiveness of the code and how the maritime industry is adjusting to the new rules and regulations within different national waterways and marine safety regimes. During upcoming Arctic Council meetings and within the Protection of the Arctic Marine Environment (PAME) working group the topic of the sharing of Arctic ship-traffic information among the eight Arctic-state maritime administrations should be a priority issue. Agreement on traffic-data exchange enhances marine safety and environmental protection and meshes with the basic tenets of the IMO Polar Code.

Relationship to Arctic Marine Infrastructure

AMSA considered the lack of even basic marine infrastructure in most of the Arctic (the exceptions being the Icelandic coast, the northern coast of Norway, and the northwest coast of Russia) as one of the key issues for building secure, safe, and effective navigation and operations. The adoption of a mandatory IMO Polar Code was considered an important component of "infrastructure" in that it addressed both required marine-safety equipment and mariner training/experience requirements. The necessary maritime training and education facilities were considered as integral to the entire Arctic marine safety system. However, the IMO Polar Code, focusing on ship safety and marine environmental protection, does not address any fundamental needs for search and rescue and emergency response; the code does not speak to a host of requirements including hydrography/charting, ports, aids to navigation, communications, salvage, shore-side pumping facilities, and more. There is much misunderstanding in the global community about the relationship of the code to the infrastructure gap that remains throughout much of the maritime Arctic. Only through investment by the Arctic states and new public-private partnerships will resources be applied to these essential needs in response to increasing Arctic marine operations.

FUTURE OUTLOOK

After more than two decades of effort, the IMO Polar Code will come in to force on 1 January 2017 as a unified set of polar ship rules. The Polar Code should be considered a key framework agreement and only the beginning of a long process to protect Arctic peoples and polar waters in an era of expanding marine operations. The new Polar Code is not as comprehensive as many would like. The code does not address issues such as black carbon from ship emissions, heavy fuel oil in the Arctic (already banned in the Antarctic), ballast water discharge (being addressed by another IMO convention not yet ratified), and the need for an IMO-designated Arctic emissions-control area. The Polar Code does not address some ship types, such as fishing vessels and smaller operators such as tugs and barges, all normally under the authority of the coastal state. These issues can be addressed by further amendments to SOLAS and MARPOL, and there is little doubt more adjustments will be made to the requirements for polar mariner training. There might be in the future also a need to adjust the Arctic boundaries and areas where the Polar Code is mandated based on experience in enforcing the code and the changing Arctic sea ice cover.

There is also strong interest by the Arctic states and many others to designate Arctic marine areas for protection. A regional seas agreement might be one approach; IMO designation as a particularly sensitive sea area (PSSA) could be another. It would be important to integrate the IMO Polar Code framework and its marine safety system with these initiatives to ensure compatibility with the international standards (as well as the Arctic boundaries for application of the code). Once the Polar Code is in force, new initiatives will be presented almost immediately. But it will be important for IMO and the international maritime community to gain experience in adoption of the code and operating ships under its mandate.

Perspective

Hiroyuki Yamada

The Polar Code consists of an Introduction (for both safety and environment), Part I-A (mandatory safety measures), Part I-B (recommendations on Part I-A); Part II-A (mandatory provisions on pollution prevention) and Part II-B (recommendations on Part II-A). The International Convention for the Safety of Life at Sea (SOLAS) relates to the Introduction, Part I-A and Part I-B, whereas the International Convention for the Prevention of Pollution from Ships (MARPOL) relates to the Introduction, Part II-A and Part II-B. Some important points in SOLAS, MARPOL and the Polar Code are described hereunder.

SOLAS AMENDMENTS

1.1 IMO's Maritime Safety Committee (MSC), at its ninety-fourth session, adopted in November 2014, after a few years of consideration by its sub-committees and working groups, the International Code for Ships Operating in Polar Waters (Polar Code) (resolution MSC.385(94)), related to safety provisions (Introduction, Part I-A and Part I-B).

1.2 MSC 94 also adopted amendments to the International Convention for the Safety of Life at Sea (SOLAS), 1974 (resolution MSC.386(94)), introducing a new chapter XIV to make the Polar Code mandatory, which is expected to enter into force on 1 January 2017.

1.3 SOLAS applies, in principle, to new ships (particularly related to structure). However, the new chapter applies to ships operating in polar waters, including existing ships (constructed before 1 January 2017). Existing ships shall meet the relevant requirements of the Polar Code by the first intermediate or renewal survey, whichever occurs first, after 1 January 2018.

1.4 This new chapter will not apply to ships owned or operated by a Contracting Government and used, for the time being, only in Government non-commercial service.

1.5 It is noted that the Code applies, in addition to relevant requirements of other chapters of SOLAS. The Code has provisions related to survey and certificate; it requires the Polar Ship Certificate, in addition to SOLAS certificates.

1.6 Excerpts from the new SOLAS chapter XIV are attached in annex 1.

Note:
My comments or notes are in brackets in italics: important parts are underlined; omitted provisions are denoted as " . . . "

MARPOL AMENDMENTS

2.1 The Marine Environment Protection Committee, at its sixty-eighth session in May 2015, adopted the International Code for Ships Operating in Polar Waters (Polar Code) (resolution MEPC.264(68)), related to environment provisions (Introduction, Part II-A and Part II-B).

2.2 MEPC 68 also adopted amendments to Annexes I, II, IV and V of the International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 relating thereto (MARPOL) (resolution MEPC.265(68)) to make the Code mandatory, which are expected to enter into force on 1 January 2017 (same date as SOLAS).

2.3 Since MARPOL Annexes are basically different instruments, relevant Annexes were amended, i.e. Annexes I (oil), II (noxious liquid substances in bulk: NLS), IV (sewage) and V (garbage), instead of creating one new chapter (like SOLAS). It is noted that the provisions of Part II-A of the Code are, in principle, additional requirements to MARPOL.

2.4 While MARPOL applies, in principle, to all ships (new and existing ships), Part II-A of the Polar Code has some enhanced requirements for new ships.

2.5 The Polar Ship Certificate is only related to safety, and the Code does not have provisions related to environment certificate. Instead, amendments to MARPOL include modifications to the MARPOL certificate (IOPP) and relevant documents (e.g. Garbage Record Book).

2.6 Excerpts from MARPOL amendments are attached in annex 2.

POLAR CODE

3.1 The Polar Code has the following contents (note: GBS means Goal-based standards structure, which becomes common to IMO regulations). As indicated in Table III.1, Part I-A generally follows the structure of chapters of SOLAS and Part II-A's chapters are divided according to MARPOL Annexes.

Table III.1 Contents of the Polar Code

Chapter No.	Title	Note
INTRODUCTION		**Related for both Part I and II**
PART I-A: Safety Measures		
CHAPTER 1	General	
CHAPTER 2	Polar water operational manual (PWOM)	GBS
CHAPTER 3	Ship structure	GBS
CHAPTER 4	Subdivision and stability	GBS
CHAPTER 5	Watertight and weathertight integrity	GBS
CHAPTER 6	Machinery installations	GBS
CHAPTER 7	Fire safety/protection	GBS
CHAPTER 8	Life-saving appliances and arrangements	GBS
CHAPTER 9	Safety of navigation	GBS
CHAPTER 10	Communication	GBS
CHAPTER 11	Voyage planning	GBS

CHAPTER 12	Manning and training	GBS
Part I-B: Additional guidance regarding the provisions of the introduction and PART I-A		**Non-mandatory**
PART II-A: Pollution Prevention Measures		
CHAPTER 1	Prevention of pollution by oil	
CHAPTER 2	Control of pollution by noxious liquid substances in bulk	
CHAPTER 3	Prevention of pollution by harmful substances carried by sea in packaged form	
CHAPTER 4	Prevention of pollution by sewage from ships	
CHAPTER 5	Prevention of pollution by garbage from ships	
Part II-B: Additional guidance to PART II-A		**Non-mandatory**
APPENDIX 1	Form of Certificate for Ships operating in Polar Waters POLAR SHIP CERTIFICATE Record of Equipment for the Polar Ship Certificate	(related to Part I-A)
APPENDIX 2	Model Table of Contents for the Polar Water Operational Manual (PWOM)	(related to Part I-B)

3.2 The category of ship (A, B or C) is important for applying the Polar Code. If existing ships cannot comply with the requirements of Category A or B, they may be used as Category C ships.

3.3 In Part I-A, ships' ice class (generally correspond to IACS' Polar Class) and the factor of (air) temperature are important for applying the Code to ships. The existence of ice (accretion, ingestion) is another important factor. The Polar Code refers the details of training of seafarers to the International Convention on Standards for Training, Certification and Watchkeeping for Seafarers (STCW) and its Code (relevant amendments were approved by MSC 95 in June 2015 and are expected to be adopted by MSC 96 in May 2016).

3.4 In Part II-A, chapters 1 (oil) and 2 (NLS) add the requirements to ships operating in Arctic waters, which are similar to those for Antarctic waters in MARPOL Annexes I and II. For structural requirements, there is some grace period for existing ships. Chapter 3 is kept blank since there is no difference from MARPOL Annex

3 (harmful substances in packaged form). In chapter 4 (sewage), additional requirements within polar waters are stipulated to discharge sewage, with stricter provisions for new Category A and B ships. In chapter 5 (garbage), additional requirements to discharge garbage are set out separately for Arctic waters and Antarctic area.

3.5 In appendix 1, which is referred to in Part I-A, the form of the Polar Ship Certificate, together with its record of equipment, are attached. These forms are important because some essential elements of the Polar Code are described. In Appendix 2, referred to in Part I-B, the model contents for the Polar Water Operational Manual (PWOM) is attached, to facilitate preparing ship specific PWOM.

3.6 Excerpts from the Code are attached in annex 3.

Perspective

Gillian S. Grant

INTRODUCTION

The Polar Code[1] is expected to enter into force on 1 January 2017. Its birth represents the culmination of years of effort to establish an internationally consistent set of legally binding rules for vessels operating in the harsh conditions of the Arctic and Antarctic regions. This perspective focuses on legal issues relating to the implementation of the Polar Code. It begins with an overview of events that led to the development of the code, followed by an analysis of the structure and content of the code as well as the mechanisms that will be used to give it force of law. Finally, it considers issues that are likely to arise for both flag states and port states as the code is implemented. These include challenges related to the structure of the code, the use of the "tacit amendment" procedure to give it force of law, and challenges related to encouraging uniform implementation and effective enforcement.

BACKGROUND

The sinking of the MS *Explorer*, with the stranding of some 154 passengers and crew in waters off the Antarctic Peninsula in 2007, mobilized the International Maritime Organization (IMO) to transform earlier voluntary guidelines related to shipping in polar regions into a mandatory instrument.[2] Negotiating states decided that the code would build on existing IMO conventions. In other words, the existing legal framework was to act as a baseline that would be supplemented by requirements included in the Polar Code.[3] These additional requirements would address the particular risks posed by navigating in remote and harsh polar waters. Negotiations began in 2010 and continued within the committees and subcommittees of the IMO over the next several years. The final version of the Polar Code was adopted by the Marine Safety Committee (MSC) at its ninety-fourth session in November 2014[4] and the Marine Environmental Protection Committee (MEPC) at its sixty-eighth session in May 2015.[5]

Overview of the Polar Code

The overall objective of the Polar Code as stated in its opening paragraph is to:

> *provide for safe ship operation and the protection of the marine environment by addressing risks present in polar waters not adequately mitigated by other instruments of the Organization.*

The code adopts a risk-based and holistic approach. It begins by highlighting ten hazards associated with navigating in polar regions including low temperatures, high latitudes, remoteness, environmental sensitivities, rapidly changing and severe weather conditions, and lack of experience in polar operations.[6] It then sets out measures to mitigate the risks associated with the hazards. Paragraph 3.2 of the code expressly acknowledges that risk levels and the appropriate mitigation measures may differ depending on the geographic location of the vessel and time of year.

Structurally, the code consists of an introduction and two parts. Part I deals with safety measures and part II with pollution-prevention measures. Each part is further subdivided into mandatory measures and additional guidance or voluntary measures. The introduction contains mandatory measures applicable to both parts. Safety measures include requirements with respect to ship structure, stability, water- and weather-tight integrity, machinery installations, fire safety and protection, lifesaving appliances and protection, navigation safety, communications, voyage planning, crewing, and training. Pollution-prevention measures address pollution from oil, noxious liquid substances, sewage, and garbage, by establishing operational and structural requirements.

Application of the Polar Code

The Polar Code generally has the same scope of application as the International Convention for the Safety of Life at Sea (SOLAS) and the International Convention for the Prevention of Pollution from Ships (MARPOL). The safety provisions apply to "ships operating in polar waters, certified in accordance with chapter I" of SOLAS (i.e., vessels that are over 500 gross tonnage (GT) or that carry twelve or more passengers).[7] This rather awkward wording was adopted to ensure that the Polar Code would cover SOLAS ships engaged on voyages in waters outside the jurisdiction of one state but that start and end in that state. Ships engaged on such voyages, which are particularly common in the southern ocean, would not normally be subject to SOLAS as they do not fit under the SOLAS definition of an "international voyage."[8]

The application of the pollution-prevention provisions of the code aligns with the relevant MARPOL annexes. Thus, measures related to oil pollution generally apply to all ships; measures related to noxious liquid substances apply to all ships certified to carry such substances in bulk; sewage provisions apply to all ships of more than 400 GT and ships of less than 400 GT certified to carry more than fifteen persons; and the provision related to garbage applies to all ships. The sewage provisions, like the safety provisions, have been extended. They are intended to apply not only to ships on international voyages, as required by annex IV of MARPOL, but also to ships certified under annex IV of MARPOL that operate in polar waters.[9] Thus, the Polar Code rules apply even if the ship is not on an international voyage as defined in annex IV.[10]

As with both MARPOL and SOLAS, the code does not apply to ships on government noncommercial service.[11] Similarly, the existing exceptions to compliance in the conventions related to force majeure and saving lives at sea apply to the additional obligations in the code.[12]

Giving the Polar Code Legal Effect

Negotiators considered several options to make the Polar Code legally binding. These included implementing the code through amendments to the SOLAS Convention; a new stand alone convention; or amendments to multiple IMO conventions (e.g., SOLAS; MARPOL annexes; Standards of Training, Certification, and Watchkeeping (STCW), etc.). Following discussions and advice from the IMO's Legal Secretariat,[13] the MSC and MEPC decided that the code would remain a stand-alone document that would be given force of law through incorporation by reference into the relevant IMO conventions as a consolidated text. The committees further decided that the amendments to incorporate the code would be made using the tacit-acceptance procedures in each convention.

The IMO's major conventions each provide for a tacit-acceptance procedure. In broad strokes, tacit acceptance works by having amendments to conventions enter into force automatically on a particular date unless they are objected to by a prescribed number of state parties to the convention before that date. Even if amendments developed this way enter into force internationally (i.e., they are not objected to by the requisite number of states), individual state parties will not be bound by particular amendments if they object to their application to themselves within the prescribed timeframe. The tacit-acceptance procedure obviates the need to have a formal amending protocol and positive action by states to accept the amendment and become a party to the protocol each time a convention is updated. For these reasons it allows conventions to be amended more quickly and with less administrative burden than would otherwise be the case.

The Polar Code will be implemented through amendments to the SOLAS and MARPOL conventions.[14] However, the tacit-acceptance procedures under each convention will be applicable only to the part of the code that contains subject matter relevant to that convention.[15] As a result, the mandatory safety provisions will, assuming they are not objected to in accordance with the tacit-amendment procedure, be given force of law through incorporation into a new chapter XIV of the SOLAS convention. Mandatory pollution-prevention measures will be given force of law through incorporation into the relevant annexes of the MARPOL Convention. Each annex of MARPOL will contain a new chapter that incorporates relevant provisions of the Polar Code by reference and makes them binding on ships subject to the that annex. In addition, amendments will be made to existing MARPOL regulations in each annex to address the fact that the convention already contains certain operational requirements for ships operating in Antarctic waters. The coming into force of the amendments to both SOLAS and MARPOL to implement the code has been coordinated for 1 January 2017. Subsequent amendments to the STCW convention to address crew qualifications and training as well as to other conventions will follow using the same process as Polar Code requirements supplementing these conventions are developed.

Implementing the Polar Code through incorporation of its requirements via the tacit-acceptance procedures in SOLAS and MARPOL has the effect of keeping the code intact as a comprehensive document. It was also a pragmatic way to ensure swift, and likely widespread, implementation given that 98.6 percent of the world's merchant fleet adhere to SOLAS and well over 90 percent adhere to MARPOL annexes I.V.[16] Past practice has shown that it is relatively rare for states parties to these conventions to object to amendments implemented through the tacit-acceptance process.[17] Thus, there is a good chance that the code will be applicable to a significant percentage of the world's shipping tonnage by 2017. The result should be to significantly improve baseline safety and environmental protection standards for shipping in polar regions, particularly in the high seas.

IMPLEMENTING THE CODE: LEGAL CHALLENGES

On the whole, the advent of the Polar Code is a positive development. However, there are likely to be several practical challenges to overcome to ensure its effective implementation. The remainder of this perspective will examine some of these from a legal perspective. I focus on practical challenges related to effective enforcement and uniform application.

Effective Enforcement

Overview of Flag and Port State Oversight—Before discussing specific enforcement challenges, I will provide a brief overview of the international law framework that relates to flag- and port-state oversight. Primary responsibility for ensuring that a vessel meets relevant international and domestic standards rests with its flag state. The United Nations Convention on the Law of the Sea (UNCLOS) requires each state to regulate conditions on board ships flying its flag, including taking measures to ensure that its ships conform to generally accepted international rules and standards related to ship construction, equipment, and crewing.[18] The primary role of flag states in vessel regulation is recognized in both SOLAS and MARPOL. These conventions leave it to the flag state to set standards consistent with the conventions and to certify ships flying under its flag to ensure that they comply with these standards. Thus, flag states that do not object to the provisions of the Polar Code through the tacit-amendment process will play a primary role in ensuring that their ships meet the code's requirements.

Under the IMO's regulatory regime, port states play a critical role in bolstering flag-state oversight, by carrying out regular inspections of vessels that call at their ports to verify compliance with standards set out in IMO's conventions, or if the vessel is not flagged with a state that is a party to the conventions, standards that are at least as stringent.[19] Both SOLAS and MARPOL set parameters for port-state control. Under the conventions, port-state inspection of parties to the conventions is generally limited to inspecting a vessel's certificates. Further physical inspections may be undertaken if the examination of certificates reveals that there are clear grounds for believing that the condition of a vessel or its equipment does not correspond substantially with the particulars in the documents. A port state may detain a vessel that does not meet the relevant standard. [20]

That said, it is important to note that under UNCLOS and customary international law, port and coastal states retain the ability to regulate and take enforcement action against foreign ships within waters under their jurisdiction. The powers they have in this regard depend on the maritime zone in which the ship is located and are discussed in more detail below.

In addition to the legal rights and obligations imposed on port states under UNCLOS and relevant conventions of the IMO and the International Labour Organization (ILO), maritime administrations in most port states have entered into regional memoranda of understanding (MOU) on port-state control.[21] These agreements allow for a coordinated approach to verifying compliance with IMO and ILO conventions. In essence, states that are signatories to the MOUs coordinate the inspection of ships entering their ports to verify compliance with the requirements as set out in IMO and ILO conventions focusing on those ships identified as being higher risk. Each national authority applies the instruments listed in the MOU that are in force and to which it is a party. Inspection data are centralized in databases to which other signatories to the MOUs have access and which are used to track the compliance of a particular ship and to exert pressure on flag-state administrations to ensure that its substandard ships fully comply with international standards.

Time Lines—The IMO's decision to implement the Polar Code through the tacit-acceptance procedure in MARPOL and SOLAS may pose challenges for effective enforcement in the short term. Depending on the mechanism individual states use to implement the code in their domestic laws, there could be delays in national adoption of the code's requirements past the 1 January 2017 entry-into-force date. States that must make statutory or regulatory amendments to implement the code will need to take steps early on to begin shepherding these measures through their national law-making processes. Failure to meet the timelines could result in unequal application of the instrument across states, at least initially. This is particularly the case for port-state enforcement as port states that have failed to implement the requirements of the code in their national laws will be unable to issue penalties for non-compliance either for vessels under their flag or that call at their ports.

The tight time lines could also pose challenges for shipowners and operators, flag states, and the classification societies delegated to act on their behalf. The Polar Code requires SOLAS ships to have a Polar Ship Certificate to demonstrate compliance with the mandatory safety provisions of the code.[22] In the case of all but certain cargo ships, issuance of the Polar Ship Certificate will require a survey.[23] In addition, shipowners and operators will be required to complete an assessment of the operational limitations and hazards that the ship is likely to encounter while in polar waters and to develop a *Polar Water Operational Manual (PWOM)* that will set out plans, procedures, and/or additional equipment needed to mitigate the risks presented by these operational conditions.[24] It will take time for surveys to be completed and close coordination between shipowners and operators, classifications societies, and the relevant administration to meet deadlines set out in the code.[25] This is particularly the case for owners, operators, and administrations that have not previously had much experience in polar operations. The challenges in developing a robust *PWOM* may be exacerbated by the fact that the IMO is still working on developing guidance on an appropriate approach for voyage limitations to ensure that ships are armed with a systematic method to avoid encountering situations that will exceed their operational capacities. [26] Similar issues are likely to arise when amendments are made to the STCW Convention regarding training for masters and crews.[27]

Goal-Based Standards—A second enforcement challenges relates to the code's use of goal-based standards. Early on in the negotiations to make the Polar Code mandatory, a decision was made to align the safety components of the Polar Code with the Goal-Based Standards (GBS) approach adopted elsewhere in the SOLAS Convention.[28] Thus, the safety measures in part I of the code are structured so that each chapter sets out an overarching goal, followed by functional requirements to fulfill the goal, and finally regulations that set out prescriptive measures to satisfy the functional requirements.[29] Chapter 1.1, for example, specifies that a ship shall be considered to meet a functional requirement when either:

- [its] design and arrangements comply with all the regulations associated with the functional requirement; or
- part(s) or all of [its] relevant design and arrangements have been

reviewed and approved in accordance with regulation 4 of SOLAS chapter XIV, and any remaining parts of the ship comply with the relevant regulations.

The use of GBS reflects current practice at the Marine Safety Committee of the IMO and reflects a more general move to performance- or management-based regulations in many member states. However, while it may help reduce risks in a holistic and individualized fashion, the use of the GBS could create ambiguities that may hamper the effective implementation of the Polar Code. For example, although the code is explicit that meeting all the requirements in the regulations will deem the functional requirements to be met, many of the regulations that ostensibly set the prescriptive standards are vague and open to interpretation.

Chapter 6 on "Machinery Installations" serves as an example. The goal of the chapter is: "to ensure that machinery installations are capable of delivering the required functionality necessary for safe operation of ships." To achieve the goal, the functional requirements of chapter 6.2 set out a number of environmental conditions that will need to be taken into account to ensure that ships can operate safely in polar waters. These include, ice accretion and/or snow accumulation, ice ingestion from seawater, freezing and increased viscosity of liquids, seawater intake temperature, and snow ingestion. In order to comply with the functional requirements of paragraph 6.2.1.1, taking into account the anticipated environmental conditions, regulation 6.3.1.1 requires that:

- machinery installations and associated equipment shall be protected against the effects of ice accretion and/or snow accumulation, ice ingestion from seawater, freezing and increased viscosity of liquids, seawater intake temperature, and snow ingestion;
- working liquids shall be maintained in a viscosity range that ensures operation of machinery; and
- seawater supplies for machinery systems shall be designed to prevent ingestion of ice or otherwise arranged to ensure functionality.

As this example illustrates, the regulations in the code are supposed to set objective standards to assist in determining if the more general functional requirement is met. However, they often leave significant discretion to shipowners and operators regarding how ships will fulfill the requirements. This could lead to lack of uniformity and increased risk, particularly for flag states that have little experience with polar shipping.[30] Perhaps more problematic, the vagueness of the requirements in the regulations could pose enforcement challenges to both flag and port states that seek to take action against noncompliant ships. Administrative or penal sanctions for violations could be sustained only following a significant amount of expert testimony to establish whether the standards set out in the regulations have been met by an individual ship. This will be both expensive and time consuming to produce and may, in some cases, result in states not taking enforcement action against noncompliant ships.

Moreover, as global warming makes Arctic waters more accessible, there could be an increase in transit voyages where no port call is made. This type of operation will put more onus on flag states and their recognized organizations (i.e., classification societies) to exercise effective oversight and to insist on strict adherence to the code's standards. It will also call upon port states, not just in the Arctic region, but around the world, to adjust their port-state procedures to ensure effective inspection for code requirements once a vessel calls at a lower-latitude destination following a polar voyage.

Because of the risks to fragile environments and the potential financial burdens in the event of a maritime casualty, Arctic states might wish to consider a region-specific port-state control agreement that would allow for more coordinated oversight and sharing of the significant burdens of staffing remote outposts. Another alternative would be to integrate a Polar Code inspection regime into existing port-state control MOUs such as the Paris and Tokyo agreements to promote a coordinated approach to inspections, information sharing, and addressing the risks posed by noncompliant ships.

Uniform Application

The uniform and universal application of the Polar Code is not guaranteed. First, not all states are parties to SOLAS and the applicable MARPOL annexes. Second, some parties to SOLAS and MARPOL could object to the application of some or all of the code to their ships. Finally, the framework for coastal-state jurisdiction in UNCLOS could lead some Arctic states to deviate from the code's requirements to impose complementary or more stringent standards on ships operating in their waters.

Tacit Acceptance—As discussed above, the drafters of the Polar Code decided to give effect to its requirements through the tacit-acceptance procedures in SOLAS and MARPOL in part because they believed that this would allow for quicker and broader implementation than a stand-alone convention. While this is likely to be the case, this method of implementation does not guarantee uniform application of the code's requirements. The fact that not all states, in particular Arctic states, are parties to all of the MARPOL annexes risks creating a patchwork quilt of discharge rules across the Arctic region.[31]

In addition, the tacit-acceptance procedures in both SOLAS and MARPOL allow a state party to formally object to the application of particular amendments to itself. In such a case, the objecting state is not bound by the amendments even if they enter into force.[32] Because the Polar Code amendments create obligations in addition to what currently exists in MARPOL and SOLAS, ships flagged with states that objected would not be required to adhere to the higher standards in the Polar Code while navigating in the high seas areas of the Arctic Ocean. This could have the effect of weakening the stronger standards established by the code. It could also undermine the code's goal of setting uniform rules for ships navigating in polar regions, at least in the short term. That said, a general tenet of international maritime law is that flag states must set requirements for their vessels that are no less stringent than generally accepted international standards.[33] Thus, to the extent that the Polar Code requirements become generally accepted international standards there is a limit to how far nonparty ships can deviate from them. In addition, the vessels of states that did not accept the Polar Code amendments would be obliged to recognize the prescriptive jurisdiction and relevant laws of coastal and port states when in waters under their jurisdiction in accordance with UNCLOS and customary international law. Also, vessel owners will also have to answer to their insurers. These factors will likely have the practical effect of pressuring nonparty states to conform to the code's requirements.

Coastal State Jurisdiction, Savings Clauses, and Article 234 of UNCLOS—UNCLOS establishes an overarching legal framework based on maritime zones that grants coastal states various powers to regulate ships in their waters. In brief, a coastal state has full sovereignty over its internal waters.[34] It may also exercise sovereignty in its territorial sea (i.e., out to twelve nautical miles) provided that it recognizes that foreign ships have the right of innocent passage.[35] This effectively grants coastal states the right to impose laws and regulations to protect, inter alia, the safety of navigation and its marine environment. However, these laws cannot apply to the design, construction, manning, or equipment of foreign ships exercising the right of innocent passage unless they reflect internationally accepted rules and standards.[36] Although freedom of navigation for foreign vessels is the rule in a coastal state's exclusive economic zone (EEZ, i.e., out to 200 nautical miles),[37] UNCLOS allows states to impose laws related to pollution prevention in their EEZs if they reflect international standards. UNCLOS also provides scope to coastal states to set pollution-prevention measures in their EEZs that are stricter than international norms provided that they are nondiscriminatory and the state can establish that the international regime is inadequate and additional measures are necessary to address the risk. Such measures must be approved by the IMO before they can be implemented.[38]

States in regions with ice-covered waters are given special additional powers to regulate these areas under UNCLOS Article 234. Article 234 recognizes a coastal state's right to unilaterally adopt and enforce special nondiscriminatory pollution-prevention and control laws that exceed generally accepted international standards for vessels operating in areas within the limits of its EEZ that are covered with ice for most of the year, provided certain conditions are met. The coastal state's laws and regulations must have due regard for navigation, protection, and preservation of the marine environment and be based on the best-available scientific evidence. Article 234 raises various questions of interpretation and is the subject of a substantial literature, which I do not propose to address.[39] It is sufficient to note that at present both Canada and Russia rely on Article 234 to impose special requirements for foreign-flagged ships operating in their Arctic waters. [40]

Negotiations of the Polar Code included discussions surrounding how the code would fit within the existing international legal framework for the law of the sea, including article 234. A specific regulation was added to chapter XIV of SOLAS to recognize that nothing in the chapter prejudices the rights or obligations of states under international law. A similar provision was not added to the pollution-prevention provisions under part II of the code because states felt that MARPOL Article 9.1 accomplished the same objective.[41]

It remains to be seen whether Arctic coastal states will adopt the Polar Code as the legal regime for ships operating within waters under their jurisdiction or whether they will seek to rely on article 234 to set additional or complementary requirements. If they take the latter approach, there could continue to be different standards across the Arctic. This could pose challenges for shipowners seeking to operate in the waters of more than one Arctic state.[42] It may also frustrate attempts to establish a unified regime for port-state control among Arctic states. Finally, if the trend toward longer ice-free periods of time in the Arctic continues there may also be questions raised regarding the extent to which Arctic coastal states may rely on article 234 to deviate from the code in the future.

CONCLUSION

Should the Polar Code enter into force internationally, as expected on 1 January 2017, it will improve significantly the baseline regulatory framework for ships operating in polar regions. The code is an innovative document that builds on existing requirements in IMO conventions and that seeks to approach the many challenges of polar shipping from a pragmatic and risk-based perspective. The pollution-prevention portion of the code will implement a number of operational restrictions on what ships may discharge in polar waters which will, at least in the case of the Arctic, significantly enhance the protection of the marine environment over what presently exists. On the safety side, the code will require shipowners, operators, flag states, and their recognized organizations to analyze the potential risks posed by their specific polar operations and to develop individualized strategies to mitigate them.

While the Polar Code is a step forward, those tasked with implementing it will face challenges. To begin, while the use of the tacit-acceptance procedure to give the code's requirements force of law will likely lead to wider implementation than would have been the case with a stand-alone convention, the deadline for complying with the new requirements will arrive quickly and will challenge both regulators and shipowners and operations to be prepared on time. This is particularly the case as some of the code's requirements, such as the Polar Water Operational Manual and voyage-limitations regime, are novel and have not had the benefit of significant IMO guidance. Second, the use of goal-based standards for the safety measures, while providing flexibility to address the myriad risks associated with polar shipping, is also likely to pose enforcement challenges for both flag and port states as goal-based standards are highly individual and often not prescriptive. Finally, it remains to be seen whether Arctic coastal states will find the code sufficiently robust or whether they will seek to rely on the savings clauses in SOLAS and MARPOL and article 234 of UNCLOS to maintain their existing regimes or to set more stringent standards for ships operating in waters under their jurisdiction. If they do so, it also remains to be seen whether this will cause significant challenges for shipowners and effective and coordinated enforcement.

There is every reason to view the problems addressed in this perspective as normal "growing pains" as opposed to major show stoppers. Practical problems can be addressed through continued discussion at the IMO as well as through close collaboration among regulators, shipowners, operators, and classification societies.

Notes

1. *International Code for Ships Operating in Polar Waters* as adopted by resolutions MSC 385(94) and MSC 386(94) and resolution MEPC 265(68) (hereinafter Polar Code).
2. P. Kikkert, "Prompting National Interests and Fostering Cooperation: Canada and the Development of a Polar Code," *Journal of Maritime Law and Commerce* 43, no. 3 (2012): 329. Prior to 2007 the IMO had developed, in 2002, *Guidelines for Ships Operating in Arctic Ice-Covered Waters* IMO Soc. MSC/Circ.1956, 23 December 2002; and the 2009 *Guidelines for Ships Operating in Polar Waters*, IMO Resolution A.1024(26) adopted 2 December 2009, IMO Doc A 26/Res 1024, 18 January 2010.
3. See DE/52/21 and MSC/86/26 para 23.32.
4. IMO Resolution MSC.385(94).
5. IMO Resolution MEPC.265(68).
6. Polar Code paragraph 3.1.
7. The Polar Code will not, at least initially, apply to fishing vessels, pleasure craft, or other ships exempted from SOLAS by operation of regulation I/3.
8. Defined in SOLAS I/2.d as a voyage from one country to which the convention applies to a port outside such a country or conversely.
9. MARPOL Annex IV c. 7 Reg. 18.1.

10. Defined at MARPOL Annex IV Reg. 1.6 as a voyage from one country to which the convention applies to a port outside such country or conversely.
11. SOLAS Regulation XIV/2.4; MARPOL Art. 3.3.
12. See SOLAS Art. IV; MARPOL Annex I Reg. 4; Annex II Reg. 4; Annex IV Reg. 3; Annex V Reg. 6.
13. MEPC 62/11/4/Add.1.
14. See SOLAS Art. VIII and MARPOL Art. 16.
15. MSC 91/8; MSC 91/22 paras 8.1-8.2; MEPC 63/23 paras 11.14-11.18.
16. See IMO Status of Conventions Chart at: http://www.imo.org/en/About/Conventions/StatusOfConventions/Pages/Default.aspx. Note that adherence to MARPOL is determined by each individual annex.
17. See http://www.imo.org/en/About/Conventions/StatusOfConventions/Documents/Status%20-%202015.pdf.
18. See, inter alia, the United Nations Convention on the Law of the Sea, Articles 91, 92, 94, and 217; see also the excellent overview of Governance of Arctic Shipping in the Arctic Council's *Arctic Marine Shipping Assessment*, 2009 report, 50–54.
19. Note that under general international law port states have the right to impose conditions of entry for ships entering their ports.
20. See SOLAS regulation I/19, MARPOL Arts. 4, 6, and 7.
21. E.g., most states that border the Atlantic Ocean are members of the Paris MOU while Pacific Rim states are members of the Tokyo MOU.
22. SOLAS regulation XIV/1.3.1 and 2.2.
23. SOLAS regulation XIV/1.3.2 and 1.3.3.
24. SOLAS regulations XIV/1.5 and 2.1-2.3.
25. Note that SOLAS regulation XIV/2.2 allows for a phase-in period for ships constructed before 1 January 2017. They will be required to meet the relevant requirements of the code by their first intermediate or renewal survey, whichever comes first after 1 January 2018. This phase-in could help relieve some of the time pressure on shipowners and operators.
26. SOLAS regulation XIV/1.5, 2.2.2, 2.2.5, 2.3.3.1, 2.3.5 and 2.3.6.
27. *International Convention on Standards for Training, Certification and Watchkeeping for Seafarers, 1978.*
28. DE 53/26 paras 18.8-18.9.
29. Note that the IMO's Marine Environmental Protection Committee rejected adopting a GBS for the pollution-prevention provisions of the Polar Code at

its sixty-sixth session (See MEPC 66/21 paras 11.23-11.27). Thus part II of the code is generally more prescriptive.

30. Thus there will be even more reliance on classification societies.

31. For example, neither Iceland nor the United States are parties to MARPOL Annex IV.

32. Legal relations between states in this situation are governed by Article 30 of the Vienna Convention on the Law of Treaties.

33. UNCLOS Arts. 94 and 211(2).

34. UNCLOS Art. 2.

35. UNCLOS Art. 17.

36. UNCLOS Art. 21.

37. UNCLOS Art. 58.

38. UNCLOS Arts 211(5) and (6).

39. See for example, D. M. McRae and D. J. Goundrey, "Environmental Jurisdiction in Arctic Waters: The Extent of Article 234," *University of British Columbia Law Review*, Vol. 16 (1982), 197–228; R. Huebert, "The Law of the Sea and the Arctic: An Unfulfilled Legacy" in *Ocean Yearbook*, 2004 (Chicago: University of Chicago Press, 2004), 193–219

40. For a good overview of the Canadian and Russian regimes see A. Chircop, "Course Convergence? Comparative Perspectives on the Governance of Navigation and Shipping in Canadian and Russian Arctic Waters" in *Ocean Year Book* 28, edited by A. Chircop, Scott Coffen-Smout, and Moira L. McConnell (Leiden/Boston: Brill Nijhoff, 2014), 269–327; See also E. Molenaar et al., "Legal Aspects of Polar Shipping: Summary Report," European Commission Directorate General for Maritime Affairs and Fisheries, released 23 February 2010.

41. See MEPC 66/21 paras 11.47–11.48 and Annex 20.

42. For an industry perspective on the prospects for the Polar Code see the paper prepared by the International Chamber of Shipping, "Position Paper on Arctic Shipping" (December 2012), at: http://www.ics-shipping.org/docs/default-source/resources/policy-tools/ics-position-paper-on-arctic-shipping.pdf?sfvrsn=20.

Perspective

Bum-Shik Park

INTRODUCTION

As the commercial value of Arctic resources and the Northern Sea Route has risen due to climate change and technological developments, countries have started to show keen interest in regulations relating to the polar regions. However, unified regulations covering the design and navigation of ships operating in the Arctic Ocean did not exist. Countries adjacent to the Arctic Ocean established and implemented regulations of their own under the basic principle of protecting and preserving the marine environment.

In the 1990s, however, the Arctic Ocean region came under consideration for the commercial operation of ships, giving rise to the need to develop unified regulations on the design and navigation of ships operating in the area. The International Maritime Organization (IMO) embarked on the establishment of universal regulations. The IMO discussed the issue within its outside working group in 1993 and decided to develop a Polar Code through the eighty-sixth meeting of the Maritime Safety Committee. Recently, the IMO adopted the Polar Code that will take effect as a binding regulation on 1 January 2017. This provides an opportunity for non-Arctic countries with freedom from polar regulations set up by Arctic countries under the United Nations Convention on the Law of the Sea. They will be allowed to build and operate ships under common international regulations. It is expected that classification societies, shipyards, and shipping companies need to address various issues to prepare for implementing the newly established Polar Code. This perspective addresses key issues, including preparations that arise from the enforcement of the code, especially from the perspective of classification societies.

HISTORY OF DEVELOPING THE POLAR CODE

Efforts to establish international regulations applied to ships navigating the Arctic Ocean began with the proposal by Germany and Russia in the early

1990s. In 1993, the outside working group (OWG), where experts external to the IMO participate, was organized to embark on the development of suitable regulations. Countries, including Canada, Finland, and Russia, near the Arctic Ocean invested special efforts. After almost ten years after the initial proposal, the *Guidelines for Ships Operating in Arctic Ice Covered Waters*, (hereinafter referred to as the "IMO *Guidelines* 2002") were announced (IMO, 2002).[1]

Since 2002, not only in the Arctic Ocean but also in Antarctic waters, maritime accidents and marine pollution regularly occurred due to expanded ship operation and offshore activities. As it was deemed likely that the occurrence of such incidents would continue to increase, the global call for a mandatory safety code for ships operating in polar waters continued to escalate. Arctic and Antarctic waters share similarities involving extremely harsh environmental condition. They both pose an inherent risk to communication systems and safety of ship crew. In terms of design, ice-strengthened structure and additional load to the propulsion system must be taken into account due to ice load. Given environmental similarities, the Antarctic Treaty Consultative Meeting (May 2004) requested amendment of the IMO *Guidelines* 2002 to enable application to Antarctic waters (IMO 2004). Under the IMO, the Sub-Committee on Ship Design and Equipment (DE), in its fifty-second meeting in March 2009, decided to expand the scope of the IMO *Guidelines* 2002 include the Antarctic waters. Due to the need to make the guidelines mandatory, it was proposed that the issue of developing a safety code for ships operating in polar waters be discussed within the DE.

In the eighty-sixth meeting of the Maritime Safety Committee (MSC) of the IMO in May 2009, a decision led by the DE was reached to come up with a ship-operation code for polar waters in addition to the existing IMO 2002 *Guidelines*. In 2010, a correspondence group was organized in DE fifty-three to complete the development of the present Polar Code by continuously reviewing documents submitted by member states. The Polar Code was adopted during the ninety-fourth meeting of the MSC and the sixty-eighth meeting of the Marine Environment Protection Committee (MEPC).

As the discussion on the Polar Code was in full swing, an agreement was concluded to apply the risk-based/goal-based approach (GBS) proposed by Germany. Therefore, codes of each chapter largely consist of three elements: goals to be achieved, functional requirements to attain the goals, and regulations to meet the functional requirements.

From structuring the Polar Code to developing the adopted draft,[2] the correspondence group carried out discussions to coordinate diverse interests of relevant countries, secure safety of ice-class vessels, and protect the environment of polar waters. It was agreed to require the *Polar Water Operational Manual (PWOM)* that specifies ways to prevent maritime accidents and minimize human loss and environmental pollution following an accident. Issues related to contents and procedures of the Polar Ship Certificate (PSC), Polar Service Temperature (PST), Polar Class (PC), and limitations of operation of ice-class vessels were addressed by the correspondence group. Discussion on issues of reinforcing the structural strength of the hull was limited, since the Polar Code refers to the existing International Association of Classification Societies (IACS) regulations in this regard. However, there were issues related to personnel training, PSC, and environmental protection that are newly adopted with the Polar Code taking effect. Thus, the level of interest from countries was high, spurring active discussion on such issues in the correspondence group between 2011 and 2014.

COMPOSITION OF THE POLAR CODE

The Polar Code is composed of mandatory requirements and additional guidance. Mandatory requirements are divided into part I-A (safety measures) and part II-A (pollution-prevention measures). Additional guidance is provided in part I-B (additional guidance to part I-A) and part II-B (additional guidance to part II-A).

Part I-A (safety measures), a mandatory requirement, has a total of twelve chapters. Regulations on securing safety of ice-class vessels are stated including general issues, *PWOM*, ship structure, stability, watertight integrity, machinery installations, fire safety, life-saving appliances and arrangements, safety of navigation, and communication. Another mandatory requirement, part II-A (pollution-prevention measures), consists of a total of five chapters. Requirements to mitigate pollution that could emanate from ships operating in polar routes are specified, including pollution by oil, sewage, and garbage.

The Polar Code is included in higher-level laws such as chapter XIV of the International Convention for the Safety of Life at Sea (SOLAS) and International Convention for the Prevention of Pollution from Ships

(MARPOL). Its implementation is planned to be mandatory starting from 1 January 2017. Tables III.2–III.4 detail the structure and each part of the Polar Code.

Table III.2 Polar Code

	Mandatory Requirements	Additional Guidance
Polar Code	Part I-A (safety measures)	Part I-B (additional guidance to part I-A)
	Part II-A (pollution-prevention measures)	Part II-B (additional guidance to part II-A)

Table III.3 Part I-A: Safety Measures

Chapter	Title	Main Contents
Chapter 1	General	Definitions (Cat A, B, C/ low temperature, Polar Service Temp.)
Chapter 2	Polar Water Operational Manual (PWOM)	Provision of sufficient information regarding the ship's operational capabilities and limitations to the owner, operator, master, and crew in order to support their decision-making process
Chapter 3	Ship Structure	Material and scantlings of the structure for their structural integrity based on global and local response
Chapter 4	Subdivision and Stability	Ensure adequate subdivision and stability in both intact and damaged conditions.
Chapter 5	Watertight and Weathertight Integrity	Provision of measures to maintain watertight and weathertight integrity
Chapter 6	Machinery Installations	Ensure that, machinery installations are capable of delivering the required functionality necessary for safe operation of ships
Chapter 7	Fire Safety/ Protection	Effective and operable fire safety systems and appliances with means of escape
Chapter 8	Life-Saving Appliances and Arrangements	Provision of safe escape, evacuation and survival
Chapter 9	Safety of Navigation	Ensure the nautical information and functionality of navigation equipment for safe navigation
Chapter 10	Communication	Ensure effective communication for ships and survival craft during normal operation and in emergency situations
Chapter 11	Voyage Planning	Provision of sufficient information to company, master and crew for safe operation of ship and persons on board and environmental protection
Chapter 12	Manning and Training	Ensure the operation of ships appropriately manned by adequately qualified, trained and experienced personnel

Table III.4 *Part II-A: Pollution-Prevention Measures*

Chapter	Title	Main Contents
Chapter 1	Prevention of Pollution by Oil	Measures and provisions to minimize oil spill from ships that may occur under adverse environmental conditions
Chapter 2	Control of Pollution by Noxious Liquid Substances in Bulk	Inspection and requirements on pollution that may be caused by noxious liquid substances
Chapter 3	Prevention of Pollution by Harmful Substances Carried by Sea in Packaged Form	No discussion
Chapter 4	Prevention of Pollution by Sewage from Ships	Measures and provisions to reduce pollution by sewage from ship operation
Chapter 5	Prevention of Pollution by Garbage from Ships	Measures and provisions to reduce pollution by garbage, especially daily trash, from ship operation

PREPARATION BY CLASSIFICATION SOCIETIES REGARDING THE MANDATORY ENFORCEMENT OF THE POLAR CODE

In terms of the rules of the classification societies, countries not located in the polar regions follow the rules of countries within the these regions with necessary modifications. For example, a ship that intends to navigate the northern waters of the Baltic Sea, which accounts for the largest share of navigation in ice-covered waters, is subject to the Finnish-Swedish Ice Class Rule (FSICR) jointly developed by Finland and Sweden. Therefore, every member society of the IACS reflects FSICR rules.

In the case of the Arctic waters of the Russian region, where ships navigate under the escort of icebreakers, regulations of the Russian government and the rules of the Russian classification society were applied exclusively. There was no recognized need to establish rules of the IACS since the route was temporarily closed due to political and climatic influences. Recently, however, the economic feasibility of the Northern Sea Route (NSR) has been increased due to shifts in Russian policy and global warming. This gave rise to the need to come up with regulations on ships operating in the Arctic Ocean alongside the existing regulations of the Russian government. In 2006, the IACS integrated the FSICR, Canadian Arctic Shipping Pollution Prevention Regulation (CASPPR) and Russia Maritime Register Shipping (RMRS) that are related to the Arctic Ocean, to announce the IACS Unified Requirements (UR). The IACS Polar Class UR, as design and building rules for ice-class ships, is reflected to the rules of member societies of the IACS and applied to the design and assessment of ships. As such, although members of the IACS have rules for ships that navigate the Arctic Ocean, the rules are linked with overarching regulations of various countries in the Arctic Ocean region.

Before the Polar Code was established, ice-strengthened ships were built under rules that reflected characteristics of different waters ships intended to navigate. However, with the Polar Code in place as a universal rule, classification societies are required to develop supporting rules and play roles that are required by the Polar Code. The key issues of preparation are as follows:

- create guidelines to assess ships and shipbuilding materials to assign PC: develop assessment techniques for the class of ice-strengthened ships newly built or modified to enable ice navigation;
- develop procedures to issue PSC: establish and define procedures to issue Polar Ship Certificate;
- compile and provide PWOM;
- develop appropriate education and training programs for ship crew who board ice-class vessels: provide technical support to deploy trained ship crew;
- develop technology and assessment procedures for navigational equipment on board ice-class vessels; and
- develop escape, evacuation, and rescue (EER) system to secure safety of lives under emergency.

TECHNICAL PREPARATIONS IN POLAR WATERS OR COLD CLIMATE

Classification societies need to make technical preparations to enable safe navigation in response to the implementation of the Polar Code as described below.

First, existing ships need to be prepared to operate in the NSR. As mentioned, because of environmental changes and advances in technology, using the NSR will provide economic benefits as the distance is reduced. The growing interest for NSR will strengthen demand for ice-class ships as well as the utilization of NSR with existing non-ice-class ships. In fact, operating existing ships in polar waters has a lot of advantages, since it would ease the burden of new shipbuilding and raise the level of operational efficiency of existing ships.

Under the current Polar Code, ships are classified into categories A, B, and C depending on their conformance with functional requirements. It would be appropriate to reclassify existing non-ice-class ships that have undergone modification to category C, on the assumption that structural safety, propulsion performance, winterization, and economic feasibility have been considered. Ships that fall under category C are incapable of icebreaking. Yet, they could be used to navigate the Baltic Sea and the NSR in summer and autumn as ice-strengthened ships if certain parts of the ship are reinforced to be able to withstand collisions with ice. This could serve as a reasonable temporary option under the current circumstances where the volume of cargo in the NSR is not large.

Second, classification societies need to analyze the risk of operating in polar waters. Ice-class ships are exposed not only to risks posed to ships that navigate oceans but also to risks including icing and freezing of ship and ship equipment, low-temperature environment, polar night, high latitude, and lack of experience of crew. Thus, an analysis of the level of risks for ice-class ships is required. The Polar Code lists risk factors for operational assessment of ice-class ships as follows:

- operation in low air temperature;
- operation in ice;
- operation in high latitude; and
- potential for abandonment onto ice or land.

Third, winterization for ice-class ships should be prepared. Ice accretion on the hull poses a serious threat to ship safety in polar waters. It occurs when water, sea spray, or wet snow makes contact with the surface of the hull and freezes. There are three kinds of icing on the hull. First, sea icing is formed when water is frozen on the exterior of the hull. Second, air icing is caused by raindrops, sprinkles, fog droplets, or wet snow. Lastly, mixed icing is a combination between the sea icing and air icing where snow and water on the exterior of the hull are amalgamated and frozen. The most frequent type of ice accretion is that on the exposed deck. It can lead to difficulty in evacuation during emergency and risk by weakening the stability of ships. For smaller ships, icing on the mast, equipment, devices, or superstructure changes the position of the "vertical center of gravity" (VCG) that could result in capsizing. With larger ships, icing generates problems in the ship control system on the upper deck and increases the volume of discharge. Ice accretion at the headwind direction is caused by spray that is perpendicular to the wind direction and shifts the "transverse center of gravity" (TCG), substantially undermining ship stability. Therefore, icing and freezing on exposed decks should be minimized and performance degradation of exposed equipment and ships prevented. In this regard, winterization is a prerequisite for ice-class ships.

Fourth, classification societies should be able to set up databases for different regions of polar waters to ensure safe navigation. Unlike warmer oceans, polar waters show environmental characteristics such as sea ice and polar night. Accurate information on the waters must be collected to plan safe navigation. Currently, the Polar Code does not provide data for different waters. However, a proposal was made to adopt the Polar Operational Limit Assessment Risk Indexing System (POLARIS) that could determine whether a ship operation is safe or not by evaluating ice conditions of the waters that a ship intends to navigate. POLARIS reflects rules developed based on experience of countries near polar waters such as Canada, Denmark, Finland, Russia, and Sweden. Yet, ice conditions in the Arctic region change in real time. Thus, the classification societies need to build databases that help operators understand the characteristics of waters that they plan to navigate.

Fifth, ship crew who board ice-class ships should be provided with appropriate training, which is absolutely necessary for ice navigation. It was agreed in the IMO to strengthen training for crew that board ships operating in polar waters. In this regard, ship's masters and officers are required to participate in special drills designed to overcome ice conditions and capacity-building training to respond to accidents, pollution, and emergencies in the polar waters prior to navigation. The problem is that ship crew capable of ice navigation is limited to a certain number of nations close to the Arctic Ocean, which is also the case for facilities and human resources for training regarding such matters. Hence, there is an emerging need to set up infrastructure for training of crew boarding ice-class ships.

The last issue of consideration is preventing pollution caused by ice-class ships. The Polar Code states mandatory requirements to prevent and minimize pollution emanating from ice navigation in part II alongside part I on safe navigation. Pollution-prevention measures in part II prohibit discharge of oil, oily mixtures, and noxious liquids. It is required that sewage and garbage from ships are discharged only after being processed at a certain distance from the coast. In response to potential accidents, fuel tanks and oily bilge water tanks should be designed to have a certain distance with the outer wall or double hull. Furthermore, against emergency worst-case scenarios, it is mandatory to establish and implement the Shipboard Oil Pollution Emergency Plan (SOPEP) or Shipboard Marine Pollution Emergency Plan (SMPEP) as required by MARPOL.

With the Polar Code set to take effect, classification societies have been striving to minimize problems regarding methods and procedures for structural and functional assessment of ice-class ships modified from existing non-ice-class ships. Efforts have been made to accurately analyze risk factors and provide technical-assessment procedures and guidelines for safe navigation in polar waters. Standards on winterization to protect equipment and systems against polar environment have been presented as well. In addition, as concerns on pollution of the Arctic have risen, technology for disaster and pollution prevention in extremely low temperatures and frozen conditions must be developed in compliance with regulations on environmental protection of polar waters.

CONCLUSION

As the Polar Code enters into force, non-Arctic countries will be presented with an opportunity to take part in developing relevant technology and regulations, independent of regulations set up by nations in the Arctic region. They will face expanding scope of possibilities to operate ice-class ships. However, response from these countries from a technical point of view is still insufficient, while states in the Arctic region have been proactively preparing for the implementation of the IMO Polar Code.[3] To uphold their national interests, these states have been coming up with the PWOM and personnel training, and investing in research and development of technology. Classification societies will need to provide a range of technical support to non-Arctic countries.

In the long run, the Arctic region is expected to provide a substantial opportunity to shipbuilding, maritime commerce, and fisheries industries. The number of projects related to the Arctic Ocean is predicted to grow.

It will be the role of classification societies to provide technical services regarding the increasing level of cargo in the NSR and resource usage in the Arctic region caused by global warming. Ultimately, classification societies are required to continuously cooperate with relevant organizations such as the Arctic Council in order to maintain the healthy environment, productivity, and resilience of the Arctic Ocean to allow for sustainable development of present and future generations. Also, they should proactively join the activities for safe utilization and environmental preservation of polar waters, enabling the leveraging of the Arctic region as a new growth engine for the future.

Notes

1. IMO, *Guidelines for Ships Operating in Arctic Ice-Covered Waters* (IMO: London, 2002).
2. Resolutions MSC.385(94) and MEPC.264(68).
3. D. W. Seo, D. H. Kim, and T. B. Ha, "Enactment Trend and Implication of the Polar Code," *Journal of Navigation and Port Research*, 38 (1, 2014): 59–64.

Perspective

Andrei Zagorski

INTRODUCTION

Provisions of the Polar Code will be made mandatory by amending the 1974 International Convention for the Safety of Life at Sea (SOLAS) and the 1973 International Convention for the Prevention of Pollution from Ships (MARPOL 73/78). States party to those conventions have a long record of implementing their provisions and addressing issues of compliance. Thus, the application of new provisions introduced by the Polar Code should not to be novel for them.

At the same time, giving full effect to the provisions of the Polar Code after its entry into force at the beginning of 2017 2017, ensuring compliance with them, and particularly their appropriate administration, is likely to challenge Arctic states to the extent that vessel traffic increases in the areas covered by the code.

Member states of the Arctic Council are parties to both conventions and relevant protocols to them except for Canada which has not yet adhered to the 1978 Protocol to the SOLAS Convention and the United States and Iceland which are not yet parties to annex IV of the MARPOL Convention ("Regulations for the Prevention of Pollution by Sewage from Ships").[1]

The code will not apply to all vessels. Spatial aspects of implementation will be of particular importance as the code seeks to govern operations by ships in waters with different legal status and under different jurisdictions. Some individual coastal states already have established national regulations for the purpose of preventing pollution of ice-covered waters from ships and in order to increase maritime safety in remote Arctic areas. However, those regulations differ significantly. They don't extend to and are not enforced throughout the entire Arctic Ocean. Although the introduction of the Polar Code will reduce existing differences in national regulations, regulatory frameworks and administrative practices will continue to differ.

The implementation of the Polar Code will thus require more cohesive policies and increased cooperation among Arctic states, between them and flag and port states outside the Arctic, the International Maritime

Organization (IMO), classification societies, shipowners, insurance companies, and other relevant actors in order to ensure that its goals are met.

The first section of this perspective addresses relevant issues regarding the *application* of the Polar Code to different categories of ships. The second section outlines the general balance of *responsibilities and rights of flag and port states* as established under international maritime law. The third section looks at the impact that specific regulations introduced by *coastal slates in the Arctic Ocean* may have on the implementation of the Polar Code. The fourth section discusses Russian policies and approaches to the Polar Code implementation. Section five summarizes the experiences of the *administration of the rules of navigation in the area of the Russian Northern Sea Route* as an example of eventual patterns of (non)compliance. Section six summarizes the findings and suggests several recommendations pertaining to the implementation of the Polar Code.

APPLICATION

For the purposes of the implementation of the Polar Code, it is important to note that provisions of the SOLAS and MARPOL conventions do not apply to all vessels navigating in the Arctic Ocean. MARPOL provisions apply to all ships except for "any warship, naval auxiliary or other ship owned or operated by a State and used, for the time being, only on government non-commercial service."[2] The list of exceptions and exemptions provided for by the SOLAS convention is longer. Its provisions generally only apply to cargo ships of more than 500 tons gross tonnage engaged on international voyages (i.e., on voyages "from a country to which the present Convention applies to a port outside such country, or conversely"[3]) as well as to larger passenger ships.

In addition to a list of exceptions from its regulations (ships of war and troopships, cargo ships of no less than 500 tons gross tonnage, ships not propelled by mechanical means, wooden ships of primitive build, and pleasure yachts not engaged in trade and fishing vessels),[4] the SOLAS convention exempts from its requirements, inter alia, ships which are "not normally engaged on international voyages but which, in exceptional circumstances," are "required to undertake a single international voyage."[5]

In other words, while the pollution-prevention measures of the

Polar Code will apply to all vessels except for warships or other ships in governmental service, its *safety measures will apply only to larger cargo and passenger ships on international voyages*. It is expected that the Polar Code safety provisions, at the next stage, will be extended to more ship categories, in particular to pleasure yachts and fishing vessels, but it is not yet clear what provisions will be necessary for this purpose.[6]

It is also important to note that safety requirements in particular areas of the Arctic Ocean covered by the Polar Code will vary during the year depending on ice conditions. The application of this regime will thus depend not only on the availability of a specific and valid ice class assigned to a ship, but also upon whether this ice class enables it to navigate in a certain area in a certain period of time, with or without an icebreaker's support. This is a different task as compared to routine SOLAS or MARPOL procedures of establishing whether a specific ship is up to assigned standard or is substandard.

STAKEHOLDERS

The implementation of safety and pollution-prevention measures will require cooperation of multiple stakeholders, among them flag, port, and coastal states; international organizations, in particular the IMO; classification societies; shipowners, operators, and masters; and others. They have different competencies and responsibilities in the process of implementation. The bottom line of the general approach, however, is that international maritime law proceeds on the basis that *primary responsibility for ensuring that ships comply with the provisions of the relevant instruments rests with the shipowners, operators, masters, and flag states.*

The government of the flag state is responsible "for promulgating laws and regulations and for taking all other steps which may be necessary to give the applicable conventions full and complete effect so as to ensure that, from the point of view of safety of life and pollution prevention, a ship is fit for the service for which it is intended and seafarers are qualified and fit for their duties."[7]

It is the government of the flag state that is responsible for the certification, inspection, and survey of ships as regards the enforcement of provisions of applicable conventions, although the flag state may delegate these functions to authorized organizations (i.e., classification societies) or surveyors nominated for that purpose. In case of any violation of the requirements of applicable conventions, sanctions are generally supposed to be established under the law of the flag state of the relevant vessel.[8]

Parties to the applicable conventions, including port states, are supposed to accept the certificates issued under the authority of another party and regard them "as having the same validity as a certificate issued by them."[9] However, admitting that, in some cases, it may be difficult for the government of the flag state to exercise full and continuous control over ships entitled to fly its flag, other parties to the applicable conventions have specific rights and responsibilities.

A ship required to hold a certificate may be subject to *inspection by any party while in the ports or offshore terminals under that party's jurisdiction*. Such inspection is generally limited to verifying that there is a valid certificate on board, "unless there are clear grounds for believing that the condition of the ship or its equipment does not correspond substantially with the particulars of that certificate" or for the purpose of verifying whether the ship has discharged any harmful substances.[10]

In case of an established violation, a party to the applicable conventions has a choice of initiating a proceeding in accordance with its own law, or to turn it over to the flag state.[11] Otherwise, ultimate measures a port state can take include the detention of a ship (e.g., for not carrying a valid certificate). In case of repeated violations, a party can deny the ship entry to the ports or offshore terminals under its jurisdiction.[12]

In order to enhance the effectiveness of port-state control procedures, *regional port-state control (PSC) regimes* have been established since 1980s in the North Atlantic, Latin America, Asia and the Pacific, the Caribbean, the Mediterranean, the Black Sea, West and Central Africa, and the Indian Ocean. The respective regimes help port states to coordinate and harmonize their PSC rules, procedures, and practices; share information; and enhance the enforcement of the applicable conventions in a cooperative manner. Ships repeatedly violating relevant provisions may be banned from entering ports of parties to regional arrangements. This cooperative practice is encouraged by the IMO.

All Arctic states except for the United States are parties to the 1982 Paris Memorandum of Understanding on PSC which, as of now, consists of twenty-seven maritime administrations and covers the waters of the European coastal states and the North Atlantic basin from North

America to Europe.[13] In addition to this, Canada and Russia, as well as China, Japan, and the Republic of Korea, are parties to the 1993 Tokyo Memorandum of understanding on port-state control in the Asia-Pacific region.[14] However, there is no regional port-state control arrangement that would bring together all Arctic states without exception, as well as all interested non-Arctic states, which would enable these states to coordinate port-state controls with a particular focus on the implementation of the Polar Code's provisions.

All stakeholders are expected to cooperate with each other in the detection of violations and the enforcement of the relevant provisions of applicable conventions "using all appropriate and practicable measures of detection and environmental monitoring, adequate procedures for reporting and accumulation of evidence."[15]

Relevant *international organizations*, and particularly the IMO, play an important role by (1) facilitating communication among member states pertaining to all issues of implementation of the relevant obligations, and, most importantly, (2) by setting specific standards relevant for maritime safety and prevention of pollution from ships. Member states of IMO are expected to follow those standards in their legislation and practices.

The Polar Code follows the logic of cooperation of multiple stakeholders in the implementation of its provisions relating to maritime safety and pollution prevention while recognizing the primary responsibility of flag states. At the same time, in many instances, the code emphasizes that, while exercising their rights, flag states shall take into account standards acceptable to IMO. It also refers to specific standards set by applicable conventions and particularly to regulations set forth in the relevant MARPOL annexes.

COASTAL STATES

In addition to general regulations pertaining to the safe and environmentally friendly exercise of the freedom of the high seas, some Arctic coastal states have established specific regulations applying to navigation beyond their territorial seas within the geographic area of application of the Polar Code.

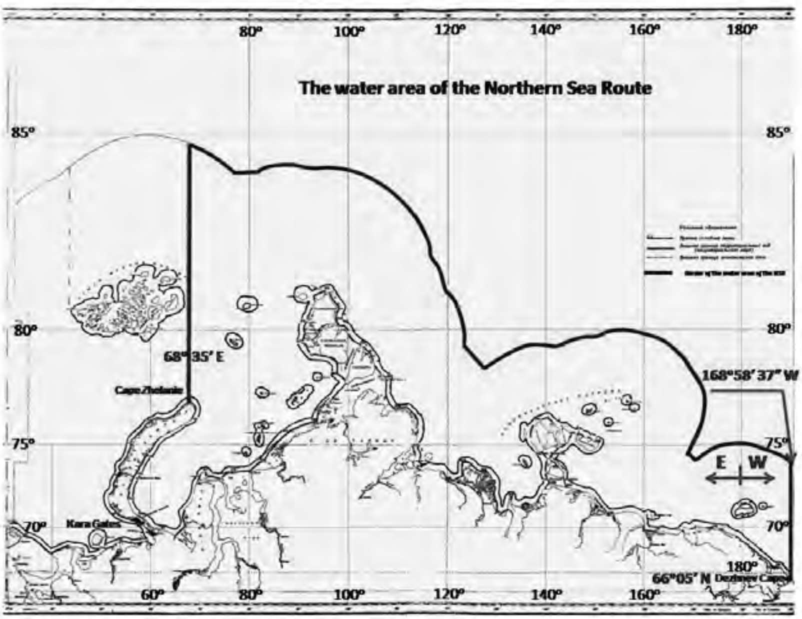
Canada and the Russian Federation practice the most intensive, although different, regulation of navigation within their 200 nautical mile (nm) exclusive economic zones (EEZ) through the Northwest Passage

(NWP) and the Northern Sea Route (NSR), respectively, requiring that ships using these routes shall meet specific safety standards and observe specific pollution-prevention regulations. For this purpose, ships are requested to ask for and receive advance permission from the authorized maritime administrations of either of the two countries.

Although Canadian regulation of vessels traffic in the NWP was introduced before the adoption of United Nations Convention on the Law of the Sea (UNCLOS), the legal ground for both countries to practice such regulation, except via customary law, is provided for in UNCLOS Article 234 which gives the coastal states "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 in 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" (emphasis added).[16] The introduction of such national regulation does not necessarily require an endorsement by IMO member states.

While, initially, regulations introduced by Canada in 1970 applied to the water area within 100 nm from its baselines, it was extended throughout its entire EEZ in 2008. In 2012, the Russian Federation also extended its NSR navigation rules to the EEZ limit.[17] The implementation of the rules established by Russia, and the consequences flowing from them for the implementation of the Polar Code are discussed below. It is important to note here, however, that Russian rules of navigation in ice-covered waters do not apply to the entire Russian EEZ along its Arctic coast. The Russian EEZ in the eastern part of the Barents Sea is excluded from the NSR by definition in order to meet the requirement of article 234 and continue regulating navigation only in that part of the EEZ which is covered by ice "for most of the year," i.e., at least for six months a year. Russian legislation thus limits the NSR to the waters from the Kara Sea with the Kara Gates being the western entry point to the NSR through the Chukchi Sea and the entry to the Bering Strait in the east (see Figure III.1).

Other coastal states practice more liberal policies but also seek to mitigate the effects of increasing vessel traffic in Arctic waters. Norway has banned the use of heavy fuel oil east of Svalbard.[18] Denmark has introduced improved port-state control of cruise ships voyaging to Greenland. Such



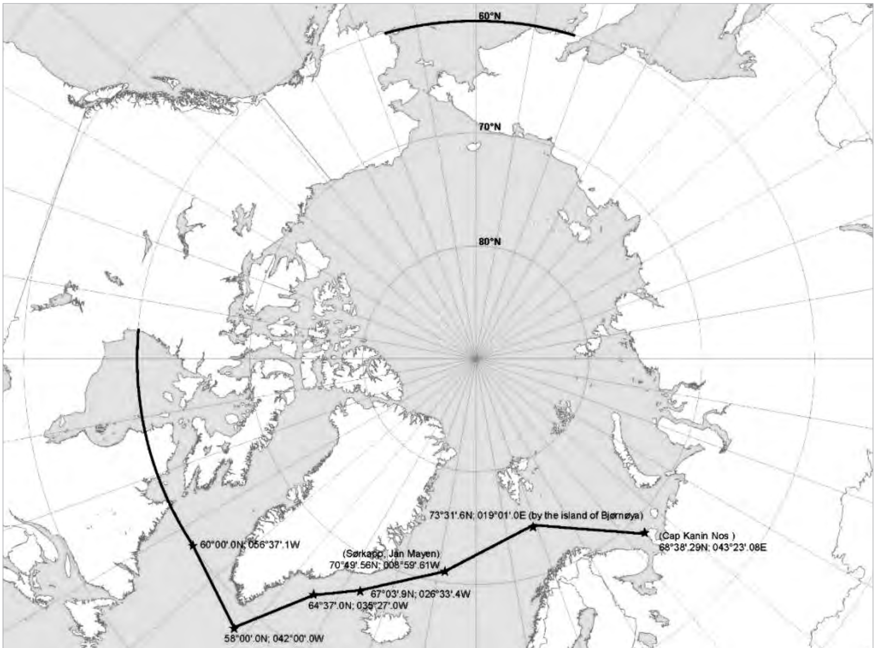
Source: NSR Administration—http://www.nsra.ru/en/granici_smp/.

Figure III.1 The Water Area of the Northern Sea Route NSR Water Area Boundaries as Defined by the 2012 Law

ships must continuously report their position to the Greenland Command. Larger ships transmit their positions via the satellite-based Long Range Identification and Tracking system, and surveillance is expected to be improved using new technologies.[19]

For the subject matter of this perspective, it is worth noting that areas in the Arctic Ocean to which specific coastal states' legislation extend are not identical with the geographic application of the Polar Code (see figure III.2). There are no regulations by any coastal states extending to the high seas in the central Arctic Ocean beyond EEZ limits. The eastern part of the Barents Sea is not subject to Russian NSR regulations but it is subject to the Polar Code provisions.

Apart from domestic regulations, Arctic coastal states also seek other special measures to be adopted, not least through IMO. Upon the initiative of Norway and the Russian Federation, the IMO Maritime Safety Committee adopted in 2012 a mandatory ship-reporting system for the Barents Sea area (Barents SRS) applying to several categories of ships



Source: MSC 94/21/add.1 annex 6, page 9.

Figure III.2 The Polar Code Area of Application in the Arctic

passing through or proceeding to and from ports and anchorages in the Barents SRS area.[20]

RUSSIAN VIEWS

There always have been and there still are champions and skeptics of the Polar Code in Russia. Apart from different and often controversial interests and motives driving specific approaches of individual business operators or environmental organizations, the bottom line of Russian policies regarding the Polar Code is based on two main considerations.

First, the government desires to assert Russia's jurisdiction over the NSR (i.e., to maintain the existing NSR regulation), at least as long as this area is covered by ice "for most of the year." Apart from the legal discourse, this desire is historically strongly motivated by traditional (military) security considerations.

From the governance perspective, it is not expected that the introduction of the Polar Code will interfere with the existing Russian regulation of vessel traffic in the NSR. Apart from legal grounds, the simple argument is that the safety regulations of the Polar Code would apply only to a tiny portion of that traffic, since they would apply only to larger passenger and cargo ships engaged on international voyages.

In 2014, the NSR Administration issued a total of 631 permissions for navigation in the NSR water area.[21] Only 5 percent of the voyages in that year qualified as transit voyages through NSR, while only six transiting ships out of thirty-one were flying a foreign flag.[22] Most of the voyages falling under the definition of transit passages are operations between the Russian port of Murmansk located outside the boundaries of the NSR in the Barents Sea and ports in Northeast Asia (e.g., China, Republic of Korea, and Singapore) or Southeast Asia (e.g., Thailand).[23]

As a result, subjects of safety regulations under the Polar Code and Russian domestic legislation are not identical. The Polar Code safety provisions do not apply to about 95 percent of vessel traffic in the NSR area while Russian national regulations apply to all vessels. At the same time, Russia is supposed to benefit from the introduction of international safety regulations by avoiding, or at least limiting, unregulated vessel traffic in the central Arctic Ocean where its national measures do not apply.[24] In that context, however, the introduction of the Polar Code raises the question of how its provisions, particularly in the central Arctic Ocean, can be administered and enforced.

Proposals to that end include either allowing states to establish regional measures to ensure compliance with the code's provisions,[25] or to allow coastal states to administer and/or to enforce them.[26] However, an agreement on either of those proposals is hard to achieve since flag states usually tend to protect their rights, particularly in areas that do not fall under UNCLOS Article 234.

Second, it is the desire of the Russian government *not to allow international regulations to straightjacket Russian maritime operations in the NSR area through establishing rigid environmental restrictions*. This approach is based on the assumption that, contrary to general belief, no significant foreign-vessel traffic along the NSR[27] (other than by vessels flying foreign flags but serving Russian operations in the North) is expected to occur any time soon. While projecting increased vessel traffic along the NSR, Russian authorities proceed on the basis that this will be primarly due to the growth of westbound (and much less so of eastbound) maritime export of mineral resources extracted in the Russian terrestrial Arctic. This is the single reason for the Russian government to support the construction of a new generation of nuclear powered icebreakers.[28]

In other words, the underlying expectation is that destination shipping will continuously dominate vessel traffic in ice-covered Arctic waters. As a consequence, robust pollution-prevention measures in this area are often seen as restricting Russia's maritime operations vital for the development of Arctic resources.

Russian domestic regulation of vessel traffic in the NSR is largely centered around safety issues and, different from the Canadian regulations, to a much lesser extent around pollution-prevention measures. Since the Polar Code *safety provisions* are considered to be largely consistent with requirements of Russian regulations, the introduction of the code is widely supported by the shipping industry,[29] and particularly by large shipping companies, such as Sovkomflot, which believe that they can afford complying with the established standards.

However, many *pollution protection measures* included in either mandatory or voluntary parts of the code are a major subject of criticism in Russia[30] since many Russian vessels, particularly diesel-powered icebreakers and auxiliary vessels using bunker-oil fuel, would hardly be able to meet the requirements; many of them would have to be either modernized or simply replaced.[31] Entirely banning pollution by oil, garbage, or sewage from ships as well as banning the use of heavy fuel oil are seen as being particularly difficult[32] bearing in mind that, other than safety regulations, pollution-prevention measures of the Polar Code apply to all vessels except for warships.

For this reason, in the process of elaboration of the Polar Code, Moscow sought to exempt its vessels engaged in destination shipping in the NSR area, and particularly those operating in ice-covered waters for longer periods of time, from most of the suggested pollution-prevention measures.[33] The final compromise allowing category A ships constructed before 1 January 2017 and "operating continuously in Arctic waters for more than 30 days" to comply with the ban on discharge into the sea of oil or oily mixtures one year after the entry into force of the Polar Code[34] is seen as a suboptimal solution or even harmful to Russia's interests.[35]

Criticism extended to Polar Code provisions pertaining to pollution prevention is most likely, in the short-to-medium term, to leave the

Russian government little to no room for maneuvering when discussing further improvements of the code's environmental provisions including the introduction of a mandatory ban on the use of heavy fuel oil. However, living up to the environmental provisions of the code is primarily an economic issue for Russia rather than a political one. Discussing cooperative strategies in order to ease the consequences for Russian operators seems to be a first necessary step toward both properly implementing the environmental provisions of the Polar Code and preparing for new steps.

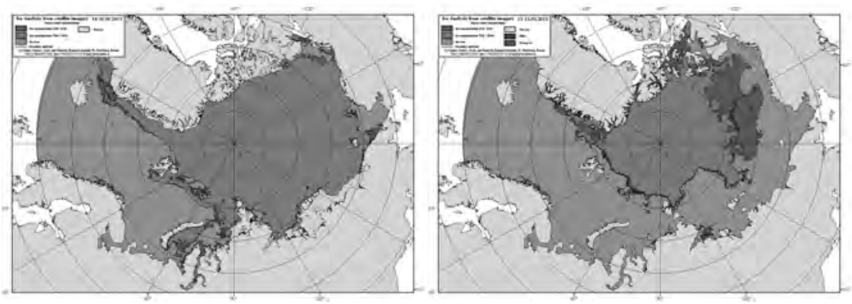
EXPERIENCES FROM ADMINISTERING NSR RULES

Experience gained by the Russian NSR Administration (NSRA) reestablished in 2013 certainly is not representative of problems that eventually may occur in the process of the implementation of the Polar Code due to different intensity and patterns of vessel traffic in different parts of the Arctic Ocean. Still, it is informative as regards the sorts of problems that may occur with regard to ensuring compliance with established provisions.

The NSRA issues permissions for navigation in the NSR area[36] based on the information provided by shipowners and/or masters in their applications including the information concerning the ice-class certificate that indicates the ice conditions and ice-covered areas in which a particular vessel is fit to operate. NSRA permissions depend on whether the specifications of the ship match anticipated ice conditions (heavy, medium, or light) in particular NSR areas in the anticipated period of navigation. Depending on the ice class, permissions specify areas within the NSR, the period, and the terms on which the ship may undertake the planned voyage on its own or with icebreaker support in particular water areas. There is a mandatory daily reporting system for the ships navigating the NSR.

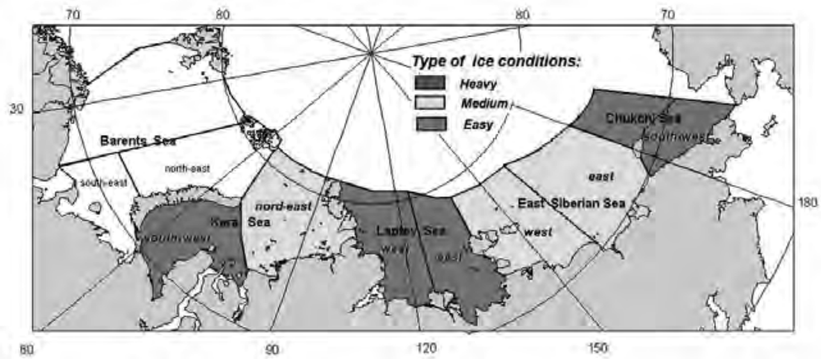
Anticipation of ice conditions is based on ninety-day forecasts that are by no means perfect in Arctic waters. Therefore, corrections are continuously introduced to terms of navigation on the basis of seventy-four-hour forecasts or actual ice conditions. Figures III.3 and III.4 exemplify the changing ice conditions in the Arctic Ocean and in the NSR in summer and autumn 2015 that resulted in different decisions taken by NSRA with regard to individual ships. However, the actual situation on the route may change rapidly even during the navigation high season. A warning issued

14–16 June 2015 **13–15 September 2015**

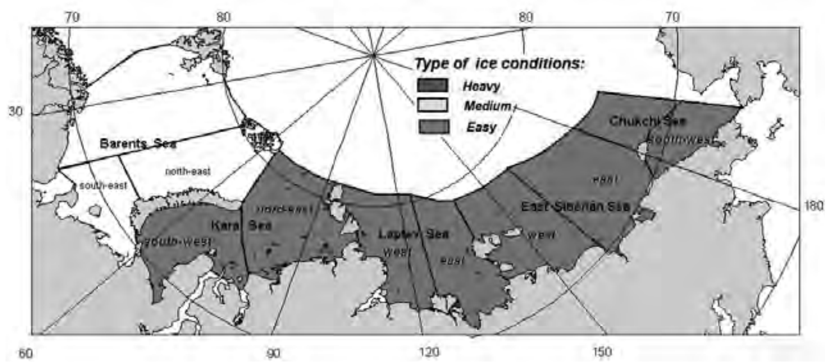


Source: http://www.aari.nw.ru/main.php?lg=0

Figure III.3 *Ice Extent in the Arctic Ocean, Summer 2015*



June—July 2015



August 2015

Source: http://www.nsra.ru/en/types_ice_conditions/

Figure III.4 *Ice Conditions Along NSR, June–October 2015* by the NSRA in September 2015 concerning the observed accumulation of icebergs in the Vilkitsky Strait, which could significantly affect navigation, in the generally easy ice conditions is one of many examples of the uncertainties accompanying navigation through the Arctic.

NSRA decisions don't require an inspection of a ship, thus accepting certificates issued by flag states or authorized classification societies. However, relevant port authorities may not only inspect vessels as part of the PSC but also are supposed to take into consideration the availability of permission and terms of navigation as defined by NSRA.

The administration is limited in its means of enforcing established rules. It may refuse permission if a vessel is not fit for the voyage or if documents provided make it impossible to establish whether or not it is fit. The NSRA relies on port authorities and reports violations to maritime administrations of flag states. As an ultimate means, it may deny permission to a ship on the

Table III.5 Refusals of Permissions to Navigate the NSR by Flag State

Flag State	**2013**	**2014**
Total	83	30
% of total applications	12	5
Russia	65	14
Other	18	16
Including:		
Antigua and Barbuda	1	0
Bahamas	0	6
Bermuda	3	0
China	1	1
Germany	1	0
Liberia	2	1
Malta	1	0
The Netherlands	6	1
Norway	1	5
Panama	0	2
Poland	1	0
UK	1	0

Source: http://www.nsra.ru/en/otkazu/

grounds of repeated violations of NSR navigation rules.

The NSRA web site displays information about permissions issued, denials, and registered violations. The latter two categories are most instructive for better understanding of compliance problems occurring in the NSR area. Tables III.4 and III.5 summarize data on refusals by flag state and by motives. These data reveal that applications are most often refused due to the lack of or invalid (outdated) classification certificates as well as the lack of or invalid civil liability for bunker-oil pollution-damage-convention certificates. In rare cases, applications are rejected because ships are not fit for navigation in anticipated ice conditions in requested areas in the relevant period of time. A large number of "other" motives mainly involve incomplete or incorrect files submitted to NSRA.

Table III.6 Refusals of Permissions to Navigate the NSR by Motive

Motives	**2013**		**2014**	
	total	**%**	**total**	**%**
Motives total*	107	100	43	100
The ice class of the ship does not correspond to ice conditions	5	5	1	2
Lack of valid classification certificate	48	45	18	42
Lack of valid civil liability for bunker-oil pollution-damage-convention certificate	28	26	4	9
Other	26	24	20	47

* since refusals often mention multiple motives, their aggregate number exceeds the number of denials.
Source: http://www.nsra.ru/en/otkazu/

CONCLUSIONS

Although vessel traffic in the Arctic Ocean is unlikely to grow exponentially in 2017 when the provisions of the Polar Code are expected to enter into force, or shortly thereafter, and while vessel traffic will continue to be spread highly unevenly throughout the Arctic Ocean, states (and particularly coastal states) need to be prepared to administer the Polar Code to ensure compliance with its provisions. This may require a number of decisions to be taken and policies to be pursued in the years to come:

- It is important to ensure that all Arctic states adhere to all relevant international instruments on which the implementation of the Polar Code is based, most importantly SOLAS and MARPOL. This may require Canada adhering to the 1978 protocol to the SOLAS Convention, as well as the United States and Iceland adhering to annex IV of the MARPOL Convention ("Regulations for the Prevention of Pollution by Sewage from Ships").

- Port-state control is important, although not sufficient, for ensuring compliance with the Polar Code requirements. One way to address the issue is for all Arctic Council states to adhere to the Paris MOU on Port-State Control. This would require the United States to join the group. Joining the Tokyo MOU is a less probable option, as five of eight Arctic Council states are geographically located outside its area of application.

However, as port-state controls in the Arctic are less frequent than in areas beyond it,[37] cooperation between Arctic and non-Arctic states in ensuring compliance with Polar Code provisions is of crucial importance for their implementation. This is particularly true as decisions to be taken by third countries' port authorities will have to take into consideration not only the availability of valid ice-class certificates but, also, the dynamically changing ice conditions throughout the year, or at least the navigation season.

This would require intensive cooperation between Arctic and other port states in terms of sharing relevant information, i.e., concerning the weather and ice condition forecasts for different parts of the Arctic Ocean, as well as cooperation in investigating alleged violations of pollution-protection measures established by the Polar Code.

This is why another option for improving port-state controls specifically with the view to improve compliance with relevant requirements for the navigation in the Arctic Ocean would be to consider establishing, if not another regional PSC MOU, a forum of interested states serving the purpose of sharing relevant information and considering cooperative action.

- Improving surveillance and domain awareness in the Arctic, including the central Arctic Ocean, reporting systems including further expansion of the use of Automatic Identification System (AIS) technology, and also improving meteorological observations and ice-condition monitoring, investing in infrastructure for currently poor hydrographic surveys, communication systems, and search and rescue capabilities, as well as preparedness and response capabilities crucial for ensuring a better implementation of the Polar Code are all important measures. In all those areas, intensified regional cooperation within the Arctic Council and/or outside of its framework will be most helpful in providing for synergies and for making a difference in cooperating with third-country port states.

- As coastal states in the Arctic enforce different regulations for navigation in Arctic waters only within their EEZs, the question of introducing some sort of Polar Code enforcement regime in the central part of the Arctic Ocean, for instance, based on a regional agreement or arrangement, may need to be revisited.
- Insurance companies can play an important role in motivating shipowners to comply with the Polar Code provisions by establishing specific compliance policies.
- Although a breakthrough on pending environmental protection issues (such as black carbon emissions or a heavy fuel il ban) is unlikely, development of cooperative strategies for the purpose of making progress in those directions not only technologically but also economically viable is important for preparing relevant decisions in the future.

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8. See, inter alia: SOLAS, Part A, Regulation 6 (a) (Inspection and Survey); MARPOL 73/78, Article 4 (1) (Violation).
9. *MARPOL 73/78*, Article 5 (Certificates and special rules on inspection of ships).
10. *MARPOL 73/78*, Article 5 (Certificates and special rules on inspection of ships); Article 6 (Detection of violations and enforcement of the Convention).
11. *MARPOL 73/78*, Article 4 (2) (Violation).
12. *MARPOL 73/78*, Article 5 (Certificates and special rules on inspection of ships).
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Perspective

Akiko Okamatsu

INTRODUCTION

By virtue of the greenhouse effect, ironically, the Arctic Ocean is now becoming a new frontier for humankind. Although Japan is not a coastal state bordering the Arctic Ocean, Japan has a keen interest in the Arctic Ocean. The Northwest Passage, connecting the Atlantic and Pacific oceans along the northern coast of North America via channels through the Canadian Arctic archipelago could yield a huge benefit for Japan; navigating this passage would significantly shorten transportation distances. Both fuel expenditures and shipping times would be reduced for much of Japanese commerce. Compared to navigation through the southern oceans, navigation through the Northwest Passage would improve maritime safety. Such traffic would, however, increase the risk of pollution in the Arctic Ocean.

In 2015, the International Maritime Organization (IMO) adopted the International Code for Ships Operating in Polar Waters (Polar Code).[1] It is intended to make more stringent the standards of both the International Convention for the Safety of Life at Sea (SOLAS) and the International Convention for the Prevention of Pollution from Ships (MARPOL).

The Polar Code requires ships operating in the Arctic Ocean to meet stricter standards with respect to their construction, equipment, etc. The Japanese government, supporting the activity of the IMO, has affirmed its intent to comply faithfully with the Polar Code. Advanced Japanese shipbuilding technologies will contribute to the production of safer ships.

This article discusses some differences among countries concerned with the application of maritime rules in the Arctic Ocean, focusing on the interaction between international law and domestic laws addressing vessel-source pollution in the Arctic Ocean.

BACKGROUND

As vessel traffic through the Northwest Passage increases, the likelihood of accidents increases. Coastal states bordering this passage would be the most affected by any pollution caused by any such accidents. Accordingly, it is no surprise that coastal states might wish to legislate the safety standards for vessels passing nearby in the Arctic Ocean and its marginal seas. The focus of this article will be on the legal status of this area.

The Canadian government considers the Northwest Passage to be part of Canada's internal waters through which foreign vessels may not pass without authorization. In contrast, the United States, some European countries and Japan maintain that the Northwest Passage should be freely navigable as an international strait.

Traditionally, vessel-source pollution has been regulated through the "flag-states principle" under the principle of freedom of the high seas. However, the flag-state principle is of limited use in managing the current problems. A regulatory response to serious marine pollution is urgently needed. Attempting to address this situation, some coastal states have begun to adopt or change domestic laws for vessel-source pollution to establish stricter standards and then to apply their laws unilaterally to foreign vessels outside their territorial seas. Such efforts by coastal states are in conflict with the view of other states insisting on the flag-state principle.

In the Arctic Ocean, landmark events include the transits of the Northwest Passage by the *SS Manhattan* and the USCGC Polar Sea. In 1969, the American supertanker (with a then-newly reinforced hull) SS Manhattan transited the Northwest Passage connecting Alaska to the east coast of the United States to demonstrate that this route was navigable throughout the year (that is, that it was not an "ice-covered area").

As Canada insists on exclusive jurisdiction over this area, the United States had intentionally sent the oil tanker to assert its right to use the passage.[2] The United States denied exclusive Canadian jurisdiction. The Canadian government again insisted that this area be recognized as Canadian internal waters. Some European states, as well as Japan, argued in support of the United States and against the Canadians in this matter.

This incident caused Canada, as a coastal state, to enact its Arctic Waters Pollution Prevention Act in 1970 and later to expand the scope of this act to 200 nautical miles.[3] Consequently, Canada has strengthened its control of the area and the Governor in Council in Canada may make regulations applicable to ships of any class specified therein, prohibiting any ship of that class from navigating within any shipping safety control zone specified therein(Article 12(1))[4].

In contrast, the United States insists, based on the provisions of articles

34 and 35 dealing with international straits in the 1982 United Nations Convention on the Law of the Sea (UNCLOS), that the legal status of this area is "international strait" and objects to Canada's unilateral actions. Many major European countries, as well as Japan, support the view of the United States[5].

Canada, however, continues to consider this passage a part of Canadian internal waters, as stipulated in article 10/6 of the United Nations Convention on the Law of the Sea. Although the United States has not ratified the United Nations Convention on the Law of the Sea, the United States recognizes it and has agreed to comply with its provisions, other than those concerning the seabed, in good faith as customary international law.

This dispute, based on article articles 34 and 35 of the convention, has developed into the situation before us today where there is a conflict between the concepts of the international strait system and the concepts of the jurisdiction of Canadian domestic law.

UNILATERAL MEASURES —THE CANADIAN ARCTIC WATERS POLLUTION PREVENTION ACT IN 1970

Background and Content of the Law

Canada believes that preventive measures before incidents happen are important and has strongly insisted on this at the International Maritime Consultative Organization (IMO). There is an agreement on the authority of coastal states to enforce their national jurisdiction regarding oil pollution damage (International Convention on Civil Liability for Oil Pollution Damage, 1969). However, there is no international rule agreed upon for vessel-source pollution on the sea because that would conflict more with the issue of international passage guaranteeing the principle of freedom of navigation.

Canada believed that it could not wait for an international agreement to be adopted and enforced to manage this concern through appropriate measures, particularly preventive ones. Therefore, Canada decided to adopt a unilateral act in this area with their domestic legislation of the Arctic Waters Pollution Prevention Act in 1970.

When Canada established its Arctic Waters Pollution Prevention Act in 1970, article 2 of the act set the area for the prevention of pollution as 100 nautical miles from the Canadian coast. Provisions remained substantially the same in the revised 1985 version except that Canada then claimed 200 nautical miles for its exclusive economic zone.

Under this Canadian law, regulations on pollution management, including provisions on the construction of vessels, passages, and standards of operation, shall apply to all vessels passing through the Canadian waters; any passage not in compliance with this law is prohibited. Article 5 states that the master of any ship shall forthwith report the deposit of waste or a condition of distress to a pollution prevention officer at such location and in such manner as may be prescribed by the governor-in-council.

Article 18 and subsequent provisions prescribe severe penalties, including fines and civil liability, for failures to honor the act.

The United States' Response and Canada's Statement

The United States: Freedom of the High Seas/International Straits—The United States, which has direct interests in this area, strongly objected to Canada's claim. The United States claimed that, according to the International Convention on Civil Liability for Oil Pollution Damage and the subsequent treaty, the authorized jurisdiction of coastal states does not extend into the high seas beyond twelve nautical miles and that Canada is not allowed to regulate vessel-source pollution in advance.

More concretely, as international law does not provide any rationale for the unilateral expansion of any state's jurisdiction into the high seas, the United States insists that it will neither accept nor tacitly permit any expansion of Canada's jurisdiction. Moreover, if that expansion were permitted, other states would also be able to expand their jurisdictions, which would cause serious international disputes. The United States also denied Canada's argument that the Northwest Passage was within Canadian internal waters. The United States further claimed that, even if Canada's expansion of its territorial sea beyond twelve nautical miles were respected, the Northwest Passage was still an international strait over which Canada could not enforce its exclusive jurisdiction.[6]

Justification of Canada's Unilateral Measures—On the other hand, Canada insisted the following:

Canada's state practice does not mean to deny the freedom of the high seas principle, nor does Canada insist on its comprehensive and absolute jurisdiction, (i.e., its sovereignty) in this area. Its practices are only intended as authorization to prevent a threat against the biological balance in the Arctic and to secure the protection of the environment against this threat. Canada says these measures can be positioned as measures "for mankind."[7]

Canada has also stated the following three points:[8]

First, it is an established international principle that international customary law has been developed by the states' practices of referring both to the jurisdiction of the coastal states over the continental shelf that was expanded by the Truman Declaration of the United States in 1945 and to Norway's claim regarding straight baselines.

Second, in this area, there is no international agreement for measures for prevention of pollution, which is a defect of the law, and Canada cannot wait for the development of international law. Therefore, it enacted the Arctic Waters Pollution Prevention Act to fulfill its responsibility to both Canadian society and international society for the protection of the coastal environment and natural resources.

Third, this will contribute to the development of international law for the prevention of marine pollution.

The end of the Canadian statement reads, "It is idle, moreover, to talk of freedom of the high seas with respect to an area, large parts of which are covered with ice throughout the year, other parts of which are covered with ice most of year, and where the local inhabitants use the frozen sea as an extension of the land to travel over it by dogsled and snowmobile far more than they can use it as water. While the Canadian Government is determined to open up the Northwest Passage to safe navigation, it cannot accept the suggestion that the Northwest Passage constitutes high seas." Canada said that its unilateral action to prevent the pollution of the marine environment was inevitable because this area was not high seas and this unilateral measure would contribute to the formation of international law for the prevention of marine pollution in the future.[9]

Strictly speaking, the Canadian unilateral measures were difficult to justify under the positive law of that time.[10] However, the original draft defined the "ice-covered area" and this would be stipulated in article 234 in the UNCLOS. With this codification of UNCLOS, the conflict between the United States and Canada changed in form to become a matter of the interpretation of article 234 of UNCLOS.

Although the United States is not and has not been a contracting party of UNCLOS, it has agreed to comply with all the provisions, other than those concerning the seabed, in good faith.

Examining the Issue in Light of the Framework of UNCLOS

In sum, before UNCLOS, Canada insisted on its jurisdiction because there was no regulation in this area and, recognizing a defect in international law, it had extended its national jurisdiction to prevent serious damage. In contrast, the United States had insisted on the principle of the freedom of the high seas according to customary international law.

However, UNCLOS has entered into force and now regulates this area. As a result, Canada insists on its jurisdiction based on article 234, identifying this area as an ice-covered area. In contrast, the United States claims that this area is not an ice-covered area as defined by article 234.

CONFLICT BETWEEN INTERNATIONAL LAW AND DOMESTIC LAWS

The Canadian claim became associated with UNCLOS at the third United Nations Conference on the Law of the Sea. The purpose of this initiative was to enforce Canada's coastal jurisdiction for the protection of the marine environment by providing additional regulation.

One of the provisions relevant to this argument is article 211(6) dealing with "a particular, clearly defined area." Another is article 234 pertaining to"ice-covered areas."

First, the former provision, article 211/6(a), reads "Where the international rules and standards referred to in paragraph 1 are inadequate to meet special circumstances and coastal States have reasonable grounds for believing that a particular, clearly defined area of their respective exclusive economic zones is an area where the adoption of special mandatory measures for the prevention of pollution from vessels is required for recognized technical reasons in relation to its oceanographical and ecological conditions, as well as its utilization or the protection of its resources and the particular character of its traffic, the coastal States, after appropriate consultations through the competent international organization with any other States concerned," may enforce their domestic measures in these areas, saying, "the coastal States may, for that area, adopt laws and regulations for the prevention, reduction and control of pollution from vessels implementing such international rules and standards or navigational practices as are made applicable, through the organization, for special areas."

However, in this case, in addition to the various requirements embedded in this provision, there is a condition that "such additional laws and regulations may relate to discharges or navigational practices but shall not require foreign vessels to observe design, construction, manning or equipment standards other than generally accepted international rules and standards."

Therefore, Canada's application of its domestic law is not always guaranteed from the perspectives of whether the contents of Canada's regulations are admitted "through the competent international organization" or not, and whether the contents of the regulations on the design, construction, manning, or equipment are beyond international standards or not.

On the other hand, regarding "ice-covered areas," the coastal states insisted on their right to enact domestic laws which are stricter than international regulations or standards, and this insistence is adopted, almost as drafted, as article 234. In this way, the coastal states became able to enforce their jurisdictions in a manner similar to that of a particular, clearly defined area, but without permission from any international organization. For example, they can enforce their jurisdiction on design, construction, manning, or equipment of ships, such as requirements for double-bottom construction or on the ship's emissions.

International Regulatory Framework and its Opposing Interpretations: Interpretation of Article 234 of UNCLOS

Now the question becomes whether or not article 234 may be applied to vessel-source pollution in the Arctic. This will be the focus of the following discussion concerning whether Canada's unilateral measures can or cannot be justified.

Article 234 may be interpreted either broadly or narrowly:[11]

A "broad interpretation" uses a literal interpretation of article 234. The article defines the location of an "ice-covered area" as "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." According to the broad interpretation, "where" in the definition of an "ice-covered area" indicates the very place itself where the coastal states may enforce their jurisdiction so that the coastal states may enact laws or regulations regarding navigation and the protection and preservation of the marine environment. That is, "where" and the subsequent phrase defines the only place where the coastal states have legislative jurisdiction.

According to this interpretation, coastal states may enforce the necessary measures based on their domestic laws both within their exclusive economic zones geographically and in the waters where it is necessary to prevent the pollution of the marine environment to protect the ecological balance. That is, the coastal states may enact domestic laws broadly, such as regulations for navigation in summer when the ice does not exist or navigation of a submarine traveling under water, even if those regulations do not regulate matters directly stemming from the severe climatic conditions, so long as ice covers the areas for most of the year, and the pollution of the marine environment may cause major harm to or irreversible disturbance of the ecological balance.

In contrast, a "narrow interpretation" indicates that coastal states may promulgate laws only for situations that are caused by "severe climatic conditions and the presence of ice" and "the pollution of the marine environment which could cause major harm to or irreversible disturbance of the ecological balance." That is, "where" means the situation or circumstances "when" the coastal states can enact legislation. In this interpretation, "where" could be understood as having a somewhat similar meaning to "when."

According to this interpretation, two legal regimes exist in ice-covered exclusive economic zones.

One is the regulation of pollution that is not caused by "severe climatic conditions" or that does not create "obstructions or exceptional hazards to navigation." For this pollution, the regime available in normal exclusive economic zones under article 211 will be applied.

The other is the regulation of areas with every other type of pollution not previously mentioned, i.e., the types of pollution addressed in article 234, where the strict regulations of the coastal states would apply. In other words, domestic laws are applied regardless of the rules usually applicable to the exclusive economic zone.

Legal Impacts which may be Caused by the Reduction of the Ice in the Arctic: Impact on the Validity of Article 234

There are two possible interpretations now, as the ice is melting and it is becoming possible to pass through the Northwest Passage throughout the year. A new issue is arising. It is now necessary to consider the potential legal impact of this situation. The present situation is that the ice has melted to the degree that a ship can pass safely through the Northwest Passage in the summer, even though not all the ice has disappeared and will not for many more years.

Regulation Based on the Domestic Law: Amendment of the Arctic Waters Pollution Prevention Act—Ever since joining the United Nations Convention on the Law of the Sea in 1996, Canada's Arctic Waters Pollution Prevention Act has been in force. Canada later declared its exclusive economic zone extended out to 200 nautical miles from the baseline.

In 2009 Canada amended the Arctic Waters Pollution Prevention Act and again expanded the area where the act would apply. In 2010 Canada further amended the act to require foreign ships to comply with these regulations. As a result, Canada strengthened its coastal state jurisdiction in this area.

Is it possible to justify this amendment from the perspective of international law?

First, if we take the broad interpretation, the last sentence of article 234, which states that the coastal states may continue to enforce strict regulations based on their domestic laws unless the ice completely melts away if "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," provides a positive answer.

However, if we take the narrow interpretation, only while the situation still exists "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" will the domestic laws of coastal states be applicable.

UNCLOS Articles 211(5), (6)/Articles 34, 35, and 36, "Straits Used For

International Navigation"—In contrast to the narrow interpretation, there is another situation in which the ice melts away in this area and there would be no more fear that "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." In this situation, article 234 is no longer applicable because this area is no longer "a particular, clearly defined area." Articles 211/5, 211/6, or, in some areas, provisions regulating international straits could be applied. Therefore, domestic laws which are stricter than the usual international regulations or criteria would be applicable in this area only when they comply with the substantial requirements set out in article 211/6 and after appropriate consultations through the competent international organization. Otherwise, international standards would be applied.

CONCLUSION

As seen above, the regulations regarding vessel-source pollution in the Arctic differ largely according to whether or not this area is regulated by article 234. As indicated, it is possible to interpret article 234 in two ways. In summary, whichever interpretation is taken, if this area corresponds to article 234, coastal states can largely regulate this area and domestic regulations that are stricter than international criteria in content, such as Canada's Arctic Waters Pollution Prevention Act, will be justified. On the other hand, if this area is not regarded as an area corresponding to article 234, then this area will fall under the purview of general international rules.

Looking back at Canada's state practice, we will need to keep watching carefully to determine whether Canadian domestic regulations are justified or not as they relate to article 234 and how other concerned states interpret this article. However, at present, it might be considered that, at least in the area within the exclusive economic zone where no state insists that it is an international strait, (i.e., in areas other than the Northwest Passage) Canadian law has led to the opposability status through the state practices based on its domestic law.

Notes

1. The text of Polar Code is on the IMO website: http://www.imo.org/en/MediaCentre/HotTopics/polar/Documents/POLAR%20CODE%20TEXT%20AS%20ADOPTED%20BY%20MSC%20AND%20MEPC.pdf (accessed 30 September 2015).
2. More details and the subsequent process are available in Donald R. Rothwell, "Global Environmental Protection Instruments and the Polar Marine Environment" in *Protecting the Marine Environment*, edited by Davor Vidas (New York: Cambridge University Press, 2000, 150–3).
3. Arctic Waters Pollution Prevention Act (AWPPA), c. 47, 1969–70 S.C. 653 (1970). The latest act is the Arctic Waters Pollution Prevention Act (R.S.C., 1985, c. A-12). In this act, "arctic waters" mean the internal waters of Canada and the waters of the territorial sea of Canada and the exclusive economic zone of Canada, within the area enclosed by the 60th parallel of north latitude, the 141st meridian of west longitude and the outer limit of the exclusive economic zone; however, where the international boundary between Canada and Greenland is less than 200 nautical miles from the baselines of the territorial sea of Canada, the international boundary shall be substituted for that outer limit.
4. Moreover, article 15 prescribes Canada's jurisdiction as follows;
   15(1) Subject to subsection (3), a pollution prevention officer may at any reasonable time
   (a) enter any area, place or premises occupied by any person described in paragraph 8(1)(a) or (b) in which the officer believes on reasonable grounds that…
   (b) examine any waste found in that area, place or premises in bulk or open any container found therein that the officer believes on reasonable grounds contains any waste and take samples thereof; and
   (c) require any person in that area, place or premises to produce for inspection or for the purpose of obtaining copies or extracts any books or other documents or papers concerning any matter relevant to the administration of this Act or the regulations.
   Powers in relation to works
   (2) Subject to subsection (3), a pollution prevention officer may at any reasonable time
   (a) enter any area, place or premises in which any construction, alteration or extension of a work described in subsection 10(2) is being carried on; and
   (b) conduct such inspections of the work being constructed, altered or extended as the officer deems necessary in order to determine whether any plans and specifications provided to the Governor in Council, and any modifications required by the Governor in Council, are being complied with.

Exception where ship or dwelling-place

…

(4) A pollution prevention officer may

(a) board any ship that is within a shipping safety control zone and conduct such inspections thereof as will enable the officer to determine whether the ship complies with standards prescribed by any regulations made under section 12 that are applicable to it within that shipping safety control zone;

(b) order any ship that is in or near a shipping safety control zone to proceed outside the zone in such manner as the officer may direct, to remain outside the zone or to anchor in a place selected by the officer, if…

5. "International law provides no basis for these proposed unilateral extensions of jurisdictions on the high seas, and the United States can neither accept nor acquiesce in the assertion of such jurisdiction.

   "If Canada had the right to claim and exercise exclusive pollution and resources jurisdiction on the high seas, other countries could assert the right to exercise jurisdiction for other purposes, some reasonable and some not, but all equally invalid according to international law. Merchant shipping would be severely restricted, and naval mobility would be seriously jeopardized. The potential for serious international dispute and conflict is obvious.

   "With respect to the 12-mile limit on the territorial sea, we have publicly indicated our willingness to accept such limit, but only as part of an agreed international treaty also providing for freedom of passage through and over international straits."

   From the United States' statement on Canada's proposed legislation (Department of State statement on Government of Canada's Bills on Limits of the Territorial Sea, Fisheries and Pollution), *US Department of State Press Release*, no. 121, 15 April 1970, reprinted in *International Legal Materials*, vol. 9, 1970, 605–6.

6. *Ibid*.

7. "The important thing is that we do, from Parliament, have authority to ensure that any danger to pollution there, and therefore any danger to the delicate ecological balance of the Arctic be prevented or preserved against by Canadian action. This is the first bit of legislation—it is not an assertion of sovereignty, it is an exercise of our desire to keep the Arctic free of pollution and by defining 100 miles as the zone within which we are determined to act, we are indicating that our assertion there is not one aimed towards sovereignty but aimed towards one of the very important aspects of our action in the Arctic."

   Canadian prime minister's remarks on the proposed legislation, (transcript of Prime Minister Trudeau's remarks to the press following the introduction of legislation on Arctic pollution, territorial sea and fishing zones in the Canadian House of Commons on 8 April 1970.), *ibid*., 601.

8. "In the other case, where no law exists, or where law is clearly insufficient,

there is no international common law applying to the Arctic seas. We're saying somebody has to preserve this area for mankind until the international law develops. And we are prepared to help it develop by taking steps on our own and eventually, if there is a conference of nations concerned with the Arctic, we will of course be a very active member in such a conference and try to establish an international regime. But, in the meantime, we had to act now," *ibid*., 601.

"Thus the proposed Canadian Arctic Waters Pollution Prevention Legislation constitutes a lawful extension of a limited from of jurisdiction to meet particular dangers, and is of a different order from unilateral interferences with the freedom of the high seas.

"It is a well-established principle of international law that customary international law is developed by state practice. Recent and important instances of state practice on the law of the sea are, for example, the Truman Proclamation of 1945 proclaiming United States jurisdiction over the continental shelf and the unilateral establishment in 1966 by the United States of exclusive fishing zones. Overwhelming evidence that international law can be and is developed by state practice lies in the fact that in 1958, at the time of the first of recent failures of the international community to reach agreement on the breadth of the territorial sea, some 14 states claimed a 12-mile territorial sea, whereas by 1970 some 45 states have established a 12-mile territorial sea and 57 states have established a territorial sea of 12-mile or more. Indeed, the three-mile territorial sea, now claimed by only 24 countries, was itself established by state practice.

"The proposed anti-pollution legislation is based on the overriding right of self-defence of coastal states to protect themselves against grave threats to their environment."

Canadian reply to the US Government, (summary of Canadian note of 16 April 1970, tabled by the Secretary of State for External Affairs in the House, 17 April 1970), *ibid*., 607–11.

9. *Ibid*., 611.

10. Discussion on this point is seen in L. Henkin, "Arctic Anti-Pollution: Does Canada Make—or Break—International Law?," *American Journal of International Law* vol. 65 (1971): 131–6.

11. D. M. McRae and D. J. Goundrey, "Environmental Jurisdiction in Arctic Waters: The Extent of Article 234," *University of British Columbia Law Review* vol. 16 (1982): 197–228, esp. 215–22.

PART IV

THE IMPACTS OF SHIFTING WORLD ENERGY MARKETS ON ARCTIC RESOURCE DEVELOPMENT

4. The Impacts of Shifting World Energy Markets on Arctic Resource Development

David L. Pumphrey

INTRODUCTION

The potential for large reserves of oil and natural gas has dominated much of the debate about the political economy of the Arctic. The prospect of energy riches is often cited as a cause for a "race" to the Arctic that could result in conflict between the nations surrounding the Arctic or with other nations anxious to secure their own supplies of energy. The reality is that, while large deposits of oil and gas have been discovered and developed, these are almost entirely in onshore areas. Large amounts of oil and natural gas are believed to exist in the offshore areas of the Arctic, but developing these resources is likely to raise a number of new technical, environmental, and geopolitical concerns. Whether these concerns develop into major new problems will depend on the amount of oil and natural gas that is ultimately discovered and the decisions by companies on the commercial viability of developing these discoveries.

The focus on the oil and gas resources in the Arctic has been driven by a number of interests. Commercial entities are interested in gaining access to the natural resources in the region in order to profit from development and sale. Local, regional, and national governments are interested in the potential stream of payments through lease acquisition, royalties, and taxation. For some of these governments, direct and indirect income derived from oil and gas development is critical to their general economy.

Perhaps the most important factor making oil and gas resources a focal point in the Arctic debate is the perception of the strategic importance of controlling large reserves of oil and gas. Since the early 1970s when rapidly rising oil demand coincided with political action by major Arab oil producers to withhold oil from the international marketplace, oil has been treated as a major element of international leverage. The paradigm for this period has been that oil resources outside the members of the Organization of Petroleum Exporting Countries (OPEC) were limited and that new major discoveries were critical to maintaining reliable, affordable supplies to assure economic growth. This view also held that demand for oil would inevitably continue to grow along with economic expansion. Gaining access to large new resources was seen as central to the diversification of oil supplies. These new supplies were expected to be increasingly difficult to access and expensive to develop. A 2007 study by the National Petroleum Council provides a recent example of this perspective of the need to continually press into new frontiers to access the oil necessary for continued economic growth.[1]

While oil has been viewed as the most strategic resource, natural gas has also been seen as important in geopolitical terms. Natural gas played a role in the efforts to shift away from oil in certain key uses, such as power generation. Perhaps more important, natural gas is seen as a strategic commodity in the European context where concerns about dependence on foreign supplies became an important policy issue during the 1980s.

In this perspective, the potential for accessing major new oil and gas resources in the Arctic is seen by major energy-consuming countries as important for energy security and by producing countries as a means of reinforcing their strategic leverage.

Recent technology and policy developments are changing the conventional view of the necessity to push into increasingly difficult, expensive, and environmentally sensitive frontier regions. These market changes could have a direct impact on the extent and timing of the development of Arctic oil and gas resources. On the supply side, technologies that allow commercial production of large resources of shale gas and tight oil have transformed the global balance of oil supply. On the demand side, policies to improve overall efficiency of vehicles and encourage use of alternative fuels and transportation methods have significantly lowered the expected future level of oil consumption. In addition, future policies designed to reduce carbon emissions could apply additional pressure on the demand for oil and natural gas.

This chapter examines the changes underway in global oil and gas markets, the estimated size of Arctic resources, the cost and barriers to development of these resources, and geopolitical factors that may affect development. Finally, the chapter presents some conclusions regarding the future of oil and gas development in the Arctic.

CHANGING NATURE OF GLOBAL OIL AND GAS MARKETS

Since the record-high oil prices experienced in 2008, international oil and gas markets have witnessed transformative changes. These changes are driven by technological developments, government policy changes, and concerns about the global environment. In this short period of time, the debate about oil and gas has shifted from one that focused on resource scarcity to one that now centers on resource abundance.

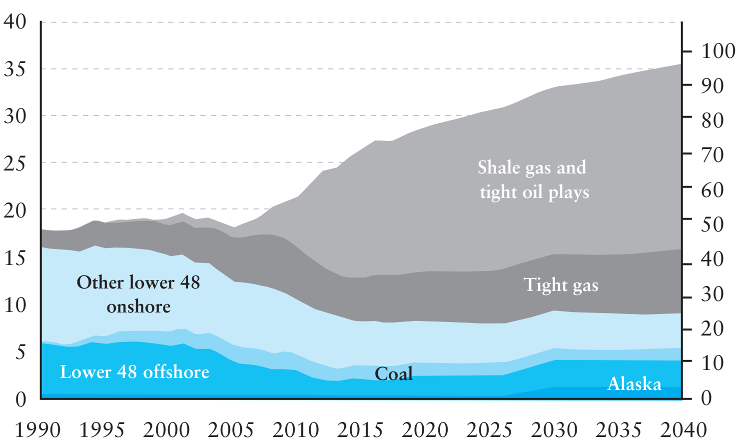
Global Oil and Gas Supply

The expectation of continually rising prices has led to many technological developments that have allowed development of large oil and gas resources that previously were not commercially viable. For example, new technologies have provided access to resources in ultra-deep water off the coasts of Angola, Brazil, and in the US Gulf of Mexico. Advanced drilling technologies combined with improved resource characterization using powerful computers makes it possible to drill wells from a single location that cover a wide area.

The most widely discussed technological advances, however, have come in the area of increasing production from oil and gas resources contained in shale and other rocks with extremely low porosity, what has become known as unconventional oil and gas. The existence of hydrocarbons trapped in these rocks had been known for many years but technologies to make production commercially possible were not available. The revolution in shale gas and tight oil resulted from applying a combination of technologies that had long been used in the oil industry. High-volume hydraulic fracturing of the tight reservoirs opens pathways in the rock to allow gas and oil to flow to the well bore. Horizontal drilling allows the production wells to maintain contact with the hydrocarbon-bearing rocks over a long distance. Sophisticated data processing provides a detailed picture of the reservoirs allowing more precise targeting of the richest hydrocarbon areas and most productive spots to fracture.

The development process for shale gas and tight oil is markedly different than that of frontier oil and gas fields in the offshore or the Arctic. Shale gas and tight oil in the United States mainland is being developed in relatively shallow (1,524–2,134 m, 5,000–7,000 feet) onshore zones where wells can be drilled and brought into production in a matter of weeks rather than years. Wells drilled to tap oil and gas in tight formations can be drilled much faster and at significantly lower cost than wells in deep water or in the Arctic. Shale gas and tight oil wells have also demonstrated relatively steep production decline curves. Sustaining production requires continual drilling of new wells in contrast to the experience with fields with large reservoirs that will sustain peak production longer and decline more slowly. These two factors—the ability to ramp up production quickly coupled with the need for continued drilling—result in production profiles that can exhibit much greater price sensitivity and elasticity than large capital-intensive projects that can take much longer to respond to price changes.

The use of high-volume hydraulic fracturing to produce shale gas commercially was first demonstrated in the Barnett field in Texas in 2002. Driven by high gas prices, the technology was then applied to several other fields in the United States. Despite the collapse of oil and gas prices in 2008, production from shale gas fields has grown rapidly and is becoming the dominant source of gas production in the United States. From 2005 to 2014, shale gas grew from virtually zero to about 40 percent of total gas production. As shown in Figure IV.1, the Energy Information

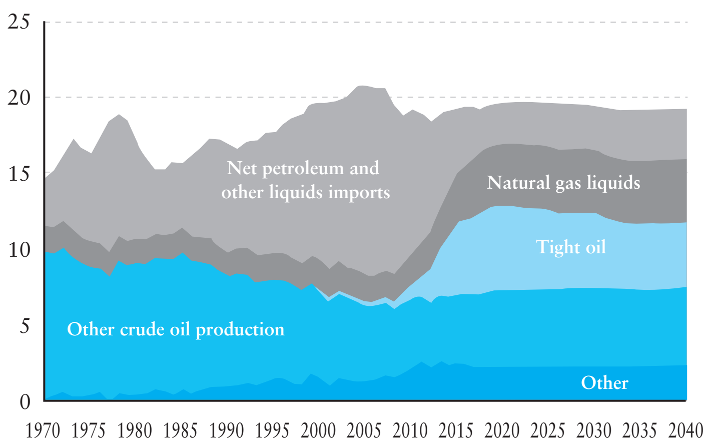


Source: US Energy Information Administration, *Annual Energy Outlook 2015*

Figure IV. 1 US Natural Gas Production, 1990–2040

Administration estimates that by 2040 shale gas will represent over 50 percent of gas production in the United States even as total gas production increases significantly. The rapid increase in domestic gas production has sharply lowered prices in the United States, creating a search for new uses in the industrial sector and as a transportation fuel. One new market for US domestic gas involves foreign users seeking cheaper gas supplies. This demand is strong enough that the United States is expected to become a net exporter of gas by 2017.

Application of hydraulic fracturing and horizontal drilling for tight oil began a few years later than in the case of shale, but the reaction of production has been similarly impressive. From 2006 through 2014, driven by tight oil production, US production of crude oil and natural gas liquids (NGL) increased by 4.8 million barrels/day, an increase of nearly 60 percent, reaching levels not seen since the 1980s. The increase in production is greater than the total crude oil production and NGL of all other countries except Saudi Arabia and Russia. The United States became the largest producer of both oil and natural gas in 2014.[2] As shown in Figure II.2, tight oil production is expected to continue to increase through the rest of this decade before reaching a new plateau. In addition the increase in natural gas production has resulted in large quantities of condensates and



Source: US Energy Information Administration, *Annual Energy Outlook 2015*

Figure IV. 2 US Crude Oil and Other Liquids Production, 1970–2040

NGLs that, along with biofuels, augment the supply of oil. Conventional crude production (shown in green in the chart) in the United States will go from being the dominant source of domestic oil to less than one-third of domestic supply by 2040 as a consequence of increases in tight oil, natural gas liquids, and biofuels.

The use of hydraulic fracturing and horizontal drilling to access shale gas and tight oil has occurred predominantly in the United States. A number of factors allowed the United States to lead in the application of this technology including a well-developed industry with many small- and medium-sized companies who could move quickly to begin drilling; private ownership of mineral rights, which allowed quick signing of leases; an extensive service industry to provide drilling and fracturing services; and a mature transportation network to take production to market. One factor that is not exclusive to the United States is the type of geology. Recent work by the Energy Information Administration and others indicates that the types of geology that could be suitable for the application of this technology are widespread globally. Figure IV.3 shows the areas that are believed to have oil and gas resources in low permeability formations.

Data from these regions has been evaluated to develop estimates of the technically recoverable oil and gas resources.[3] The estimated total technically recoverable quantity of oil is 345 billion barrels. For natural gas the total recoverable resource is estimated to be roughly 206 trillion

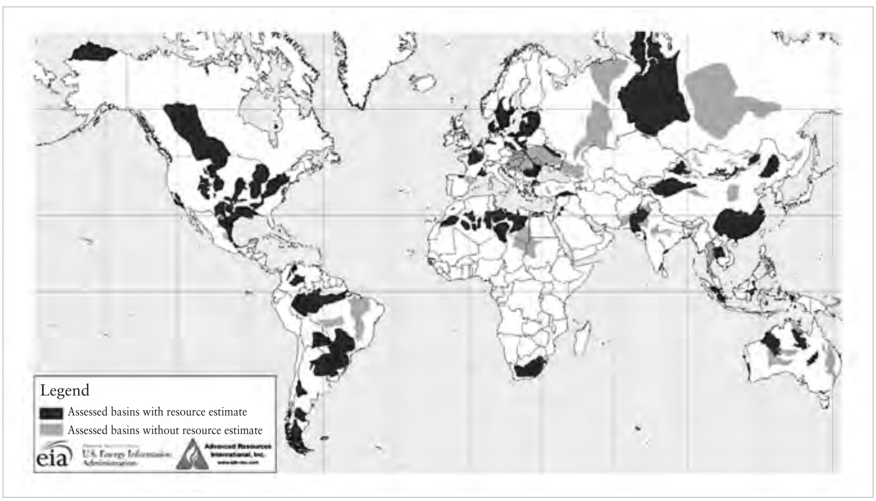


Figure IV. 3 International Shale Oil and Gas cubic meters (tcm)(more precisely, 7,299 trillion cubic feet). Because shale resources were not included in previous global estimates of recoverable resources, the Energy Information Administration (EIA) notes these estimates indicate a substantial increase in total global recoverable oil and natural gas resources. “The shale oil resources assessed in this report, combined with EIA’s prior estimate of US tight oil resources that are predominantly in shale, add approximately 11 percent to the 3,012 billion barrels of proved and unproved technically recoverable nonshale oil resources identified in recent assessments. The shale gas resources assessed in this report, combined with EIA’s prior estimate of US shale gas resources,

Table IV. 1 Estimated Technically Recoverable Shale Oil and Gas Resources

Rank	Country	Shale oil (billion barrels)
1	Russia	75
2	United States	58
3	China	32
4	Argentina	27
5	Libya	26
6	Australia	18
7	Venezuela	13
8	Mexico	13
9	Pakistan	9
10	Canada	9
	World Total	345

Rank	Country	Shale gas (trillion cubic feet)
1	China	1,115
2	Argentina	802
3	Algeria	707
4	United States	665
5	Canada	573
6	Mexico	545
7	Australia	437
8	South Africa	390
9	Russia	285
10	Brazil	245
	World Total	7,299

add approximately 47 percent to the roughly 441 tcm (more precisely, 15,583 trillion cubic feet)] of proved and unproven nonshale technically recoverable natural gas resources. Globally, 32 percent of the total estimated natural gas resources are in shale formations, while 10 percent of estimated oil resources are in shale or tight formations."[4]

As Table IV.1 shows, the largest amount of shale oil is estimated to exist in Russia with the United States second. For natural gas, the largest shale gas resources are believed to exist in China with Argentina second. While these numbers indicate a potential recoverable resource base, actually developing and producing the resources will be dependent on many factors including geology, oil prices, government policies, environmental restrictions, and public reaction.

Oil and Natural Gas Demand

Since the mid 2000s, the world's demand for oil has changed significantly. Consumption in the developed countries of the Organization for Economic Co-operation and Development (OECD) has steadily declined from a peak of 50 million barrels/day in 2005 to 45.1 million barrels/day in 2013, a decline of nearly 10 percent.[5] This decline is the result of a number of factors including response to high prices, demographic changes, and consumer preferences for vehicle use. Perhaps the most important changes, however, have been government policies that impose tighter standards for vehicle fuel efficiency to address concerns about energy security and the environmental impacts arising from the use of oil. On the other hand, developing countries' consumption of oil has increased from 34.3 million barrels/day to 47 million barrels/day over the same period, an increase of about 37 percent. The biggest increase has occurred in China, driven by strong economic growth and extremely high vehicle sales.

Looking forward, the International Energy Agency (IEA) believes that the recent trends in consumption will continue with declining oil consumption in the OECD and increases in developing countries. The latest IEA forecast for 2040 projects that global oil consumption will increase by about 14 million barrels/day, a growth rate of about 0.5 percent/year, the lowest growth rate of any fuel. At this rate, oil's share in total world energy consumption will shrink from about 31 percent to 26 percent.[6]

The declining role of oil in the global energy system has now given rise to the prospect of reaching "peak demand" for oil. Some energy-market analysts have asserted that the growth in oil demand in developing countries may not be as great as most forecasts indicate.[7] In China, the continuing expansion of automobile ownership presents difficult problems in terms of congestion and air pollution; municipalities have imposed taxes and use limits on vehicles. Developed countries may take more active measures to accelerate the decline in oil use, particularly in the United States where natural gas may grow as a fuel for trucks, trains, and boats. Even as total oil use increases slowly, the use of conventional crude actually declines by 0.2 percent in the IEA's outlook as natural gas production results in higher levels of natural gas liquids that will be integrated into the oil stream

The Paris Agreement, adopted during the December 2015 meeting of the Conference of the Parties to the United Nations Framework Convention on Climate Change (UNFCCC) could cause oil demand to begin to decline. The IEA's World Energy Outlook for 2014 includes a scenario of the global energy balance if the world took action to limit the increase in global temperatures to less than 2°C (Celsius). Oil production in this scenario is estimated to decline by 0.8 percent/year. Conventional crude oil production's decline is even greater at 1.5 percent/year. Statoil's recent Energy Perspectives scenarios also indicate that serious effort to reduce carbon emissions would reduce oil consumption through 2040 by about 0.4 percent/year.[8]

Global demand for natural gas presents a different picture than demand for oil. The growing demand for natural gas is driven in North America by lower prices due to the abundance of shale gas. Natural gas use in power plants is growing as well as in industrial and transportation sectors. In China and other developing countries of Asia, natural gas is preferred because of the air-quality issues associated with increased burning of coal. For European countries, Japan, and Korea, natural gas use is expected to be much more limited because overall energy demand growth is slower and natural gas is still relatively expensive. The latest IEA forecast indicates that total natural gas consumption will grow at about 1.6 percent/year, about three times faster than oil.

Impact on Global Oil Markets

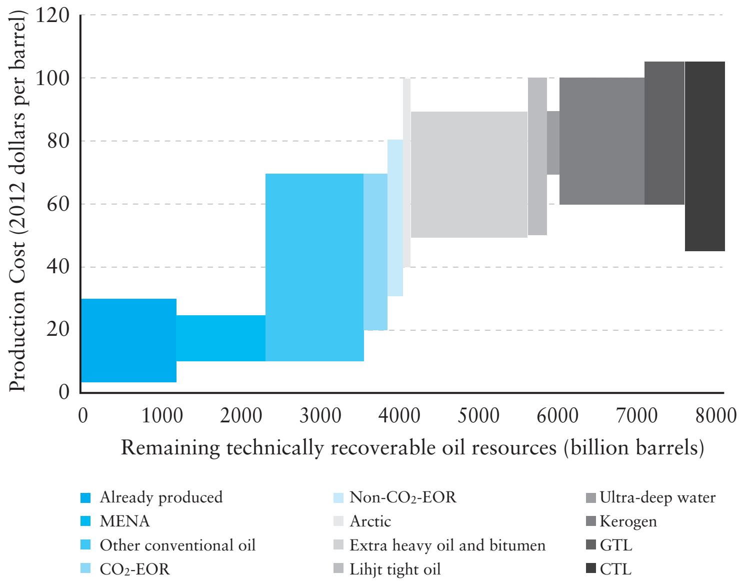
The emergence of a major new source of oil supply and a weakening demand for oil, especially for conventional crude oil, are changing the way the global oil market sets prices. Because of the long lead times to bring Arctic oil resources into production, oil companies must determine whether these market changes will lead to a significantly lower long-term price path that would not sustain positive returns.

In November 2014, after several years of growth in US tight oil production and slow growth in oil consumption, OPEC abandoned its long-time strategy of maintaining stable oil prices by adjusting production levels and decided to allow prices to balance global supply and demand more freely. This decision was driven by Saudi Arabia, the largest OPEC producer, and has been interpreted as a move to allow lower prices to slow or reverse tight oil production in the United States and to stimulate demand.

The immediate reaction to the decision was a rapid decline in oil prices. Brent crude prices fell from a level above USD 100/barrel in July 2014 to below USD 50/barrel in January 2015. Prices recovered after that time to between USD 60 and USD 70/barrel but declined sharply subsequently. The key questions facing investors is how US tight oil will respond to the lower price level: will there be rapid decline in production or will tight oil production demonstrate resiliency? The first reaction by US companies has been to reduce the number of rigs operating. As noted above, the response of production to a slow down in drilling shows up quickly. and the growth in production has slowed as a result. However, companies have continued to drill on their best prospects and the drop in production has not been as great as the drop in the number of drilling rigs.

An analysis by Ed Morse and Citi's research team concludes that the combination of a new oil supply source, which essentially extends the middle of the supply curve, and the potential of continued slow growth or even a peak in oil demand may cause higher cost investments to become "stranded." Citi's analysis indicates that tight oil can continue to grow at prices of USD 70/barrel and below. Projects most exposed to cutbacks in capital spending are those at the high end of the cost curve, including ultra-deepwater, heavy oil, and bitumen projects, and high-cost liquefied natural gas (LNG) and Arctic projects.[9]

The ultimate goal for Saudi Arabia and other Gulf producers is to maintain market share even at the expense of price levels. For the near-term this policy change is driven by the emergence of tight oil as a major factor affecting global markets. The policy is directed also at other OPEC producing countries that have been producing below capacity for



Source: International Energy Agency

***Figure IV. 4** Estimated Global Technically Recoverable Oil Resources*

geopolitical reasons, principally Libya, Iran, and Iraq. The key question for the long-term is how long this strategy will stay in effect. In a world that may see on the supply side a continuation of the expansion of tight oil production in the United States and Canada and then adoption of the technology in other countries and on the demand side continued slow growth and potentially a peak-demand situation, the major resource holders in the Middle East face the possibility that their oil will become the stranded resource of the future. The IEA data in Figure IV.4 illustrates the importance of the resources in the Middle East in the total-supply curve of oil. The Middle East has the lowest-cost resource to develop. Policies that will be deigned to support prices through underinvestment and controlled production will provide a window for the development of resources further out on the supply curve and reinforce the shift away from oil by consumers. A sustained policy of preserving market share and lowering the expected oil-price curve will impact the economic viability of the resources further out on the supply curve. Arctic oil resources fall in the middle of this curve and face the risk of becoming marginal resources.[10]

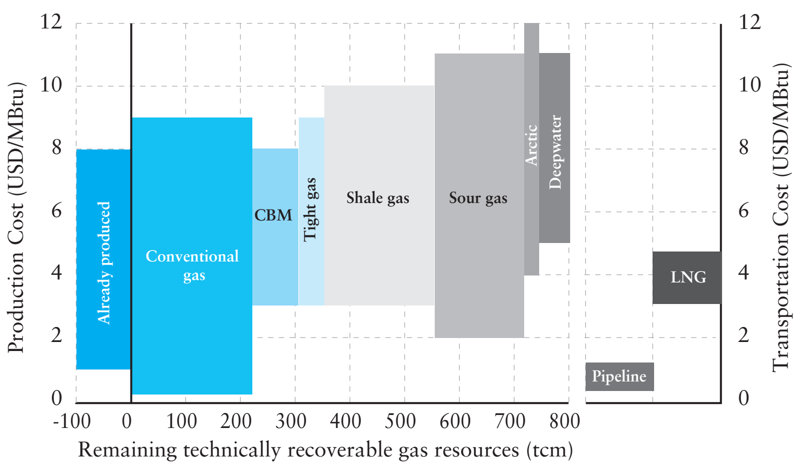
Impact on Global Natural Gas Markets

The impact of US shale gas production has been even more transformative on gas markets than on oil markets. Before shale gas technologies were proven, the United States was expected to become a large LNG importer. Both US and Canadian natural gas supplies were forecast to decline causing a need to develop the capacity for future LNG imports. Based on this expectation LNG production facilities were built in a number of countries, including Qatar and Norway, and others were planned, including the Shtokman field in the Russian Arctic. In the United States, several LNG receiving terminals were also built. The rapid rise of shale gas production caused natural gas prices to decrease to a level that made imports of higher priced LNG unsustainable. The cargoes from projects that were constructed to serve the US market were then diverted to other markets in Asia and Europe, putting pressure on spot prices.[11]

The size of US and Canadian shale gas resources soon made clear that North America could become a major new exporter of LNG rather than an importer. The first applications were received from the companies who had built facilities to import LNG and therefore had docks and storage tanks already available. These proposals were followed by a number of greenfield projects in both countries. US government approval processes were slow, as the idea of the United States as an exporter of natural gas was radically new. As of mid-May 2015, the US government had approved ten projects in the continental United States to export to any international market with a total capacity of about fourteen billion cubic feet per day (bcf/d).[12] On 3 June 2015, the Department of Energy approved the export of LNG from Alaska totaling 2.5 bcf/d.[13] While construction has begun on some of the approved projects, others will still need to gain financing and markets to move forward, and not all of the approved projects are likely to be built. The 14 bcf/d of approved export projects is equivalent to approximately 112 million tons of LNG. Total world consumption of LNG in 2015 is estimated at about 270 million tons.[14] The actual level of exports from the United States will be determined by global demand, other projects, and pricing, but the United States is clearly establishing the potential to be a major player in global markets. In its *Annual Energy Outlook 2015*, the EIA estimates that the United States will become a net exporter of natural gas, by both pipeline and LNG, in 2017. The range for possible LNG exports beyond that time is quite large. For 2030, EIA estimates range from

0.8 tcf in a low oil-price environment to about 8.0 tcf in a high oil-price environment with a reference-case estimate of 3.4 tcf.[15, 16]

The importance of the global oil price in determining US LNG exports illustrates the complex nature of the global LNG market. The high conversion and transportation costs for natural gas have led to distinct regional markets that, while linked through LNG trade to some degree, can have different prices for natural gas and different market structures. North American markets have large supplies of natural gas and therefore much more competitive markets and, at least in recent times, low prices. Competition in this market has now become gas on gas. Asian markets, principally Japan and Korea, have virtually no domestic gas supplies and prices have been linked through contract negotiations to the price of crude oil (as the best interfuel competitor) and in recent years, where oil prices have been high, natural gas prices also have been high. The European market is a mix of domestic supplies, imported pipeline gas, and LNG, and prices for natural gas are set through a combination of market processes and contracts linked to oil prices. Prices in Europe are between the North American and Asian prices. The drop in US and Canadian gas prices created strong interest in getting access to "cheap" gas through LNG exports.



Notes: CBM = coal-bed methane; LNG = liquefied natural gas; Pipeline costs refer to costs per 1,000 km; MBtu = million British thermal units; tcm = trillion cubic metres.
Source: International Energy Agency, 2013.

Figure IV. 5 Estimated Global Technically Recoverable Natural Gas Resources

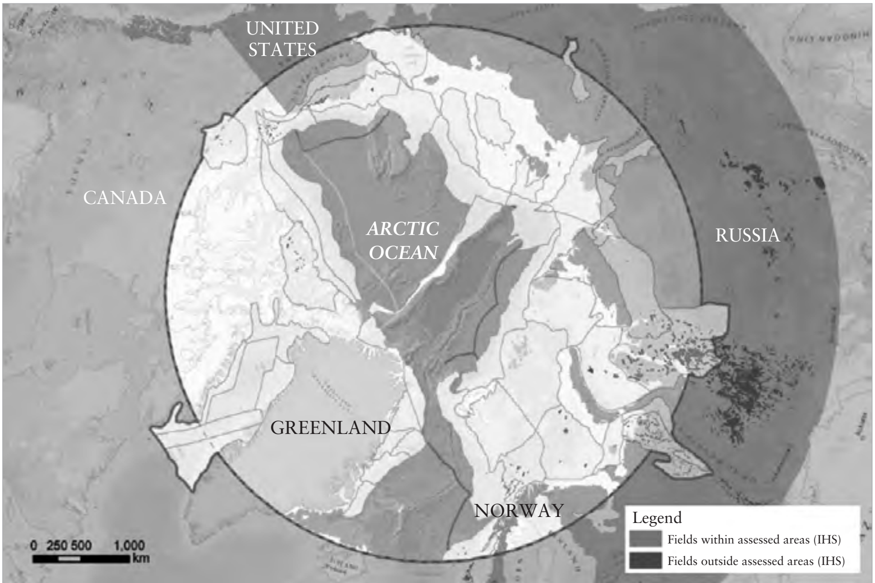
For Asian buyers the opportunity to purchase LNG from a competitive market at much lower prices became a major opportunity to develop new contract mechanisms to balance the long-term oil-linked contracts. With high oil prices, the delivered price of US LNG could be much lower than the oil-contract price even after considering liquefaction and shipping costs. With lower oil prices or higher North American natural gas prices, this margin becomes smaller. At oil prices in the USD 60/barrel range, long-term contract prices and US-sourced gas are competitive. Oil prices in this range or below make investments in expensive new LNG projects based on contracts linked to oil prices much less attractive. Conversely, oil prices high enough to justify the investment in high-cost LNG will risk much higher levels of US exports. US natural gas will directly influence the investment in higher-cost LNG facilities, including Arctic projects, by setting an upper boundary on the prices that will be offered for new gas projects. As Figure IV.5 shows, considerable potential supply exists to meet global demand. Conventional and shale gas resources are large and at cost levels that will allow development in a lower-price world.

ARCTIC OIL AND GAS DEVELOPMENT

Resources

The United States Geological Survey (USGS) published the most thorough and widely cited report on the oil and gas resource potential in the Arctic in 2008.[17] This report provided the first systematic evaluation of the oil and gas resources that might be technically recoverable in the Arctic region. The USGS appraisal estimated that the mean value for recoverable oil resources in the Arctic is nearly 90 billion barrels of oil, and roughly 47.26 tcm (more precisely, 1,669 trillion cubic feet) of natural gas.[18] The estimate of technically recoverable resources does not include any consideration of the economics of discovering and developing these resources. Also, as drilling proceeds the estimates will be refined and may change significantly.[19] In comparison, the estimate of technically recoverable shale oil noted earlier is 345 billion barrels worldwide and for shale gas, roughly 207 tcm (more precisely, 7,299 trillion cubic feet).

The National Petroleum Council (NPC) recently published the results of a two-year study on Arctic oil and gas development.[20] This report



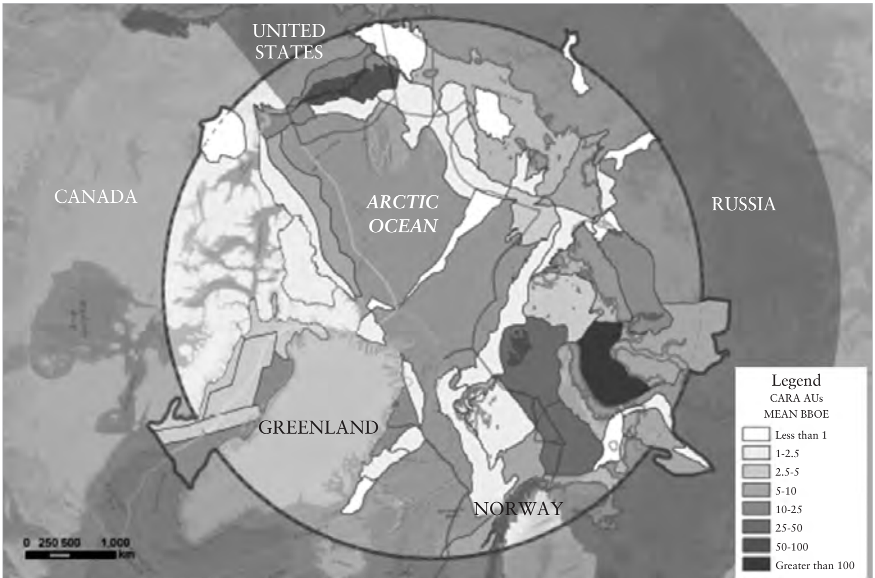
Source: National Petroleum Council

Figure IV. 6 Discovered Oil and Gas Fields in the Arctic

provides a more thorough characterization of the oil and resources in the Arctic. The report examines the resource potential from the perspective of individual countries, undiscovered vs. discovered resources, onshore vs. offshore, and type of resource.

Oil and gas exploration and development have been taking place in the Arctic since the 1960s. Russia and the United States have the largest production bases but successful exploration has also taken place in Canada and Norway. As shown in Figure IV.6, almost all of this exploration and production has taken place in onshore areas and has resulted in reserves of hydrocarbons that can be classified as proved, probable, or possible. The NPC report provides an integrated summary of the fields that have been discovered through this work.

Figure IV.7 shows the distribution of the technically recoverable, undiscovered hydrocarbon resources in the Arctic. The future for oil and gas exploration and production is clearly in the Arctic offshore where work is only now beginning.



Source: National Petroleum Council

Figure IV. 7 Estimated Technically Recoverable Hydrocarbon Resources in the Arctic

Table IV.2 provides a summary by country for the resources indicating discovered vs. undiscovered and onshore vs. offshore. Russia, which borders the largest part of the Arctic, has the largest expected resources of oil and gas. Russia is expected to have about 60 percent of the total resources, 34 percent of the oil resources and 69 percent of the natural gas. In terms of prospective basins, the highest concentration of oil resources are thought to be in the Beaufort/Chukchi Sea areas offshore of Alaska and the South Barents Sea area of Russia. For natural gas, the largest concentrations are thought to be in the South Kara Sea, South Barents Sea, and North Barents Sea regions of Russia. About 70 percent of the total discovered and undiscovered resources are believed to be natural gas. For the United States, about 50 percent is expected to be gas but for Russia about 80 percent of the resource base may be natural gas. About 75 percent of the Arctic resources are located in offshore areas. For Russia nearly 75 percent of the resources are offshore while for the United States almost 55 percent are offshore.

Table IV. 2 Estimated Technically Recoverable Hydrocarbon Resources in the Arctic

Resource type		United states		Canada		Russia		Greenland		Norway		Total
		Onshore	Offshore	Onshore	Offshore	Onshore	Offshore	Onshore	Offshore	Onshore	Offshore	
Oil (BBO)	Undiscovered	9.9	21.9	1.4	11.3	12.6	17.9	0.8	15.3	0.1	4.5	96
	Discovered	1.4	0.7	0.4	1.5	4.6	0.5	0.0	0.0	0.0	0.9	10
Total oil (BBO)		11.3	22.6	1.8	12.8	17.2	18.4	0.8	15.3	0.1	5.4	106
Natural gas (TCF)	Undiscovered	91.3	138.8	11.9	76.5	166.2	977.8	6.2	129.9	1.2	112.2	1,712
	Discovered	99.7	28.1	12.3	11.1	183.7	177.4	0.0	0.0	0.0	7.9	520
Total gas (TCF)		191.0	166.8	24.2	87.5	349.9	1,155.3	6.2	129.9	1.2	120.1	2,232
NGLs (BBNGL)	Undiscovered	2.4	3.4	0.2	1.3	4.4	23.1	0.4	8.8	0.0	1.0	45
	Discovered	0.0	0.7	0.0	0.0	1.0	0.5	0.0	0.0	0.0	0.1	2
Total NGLs (BBNGL)		2.4	4.1	0.2	1.3	5.4	23.6	0.4	8.8	0.0	0.0	47
Total reseource (BBOE)	Undiscovered	27.5	48.4	3.7	25.3	44.7	203.9	2.2	45.8	0.3	24.2	426
	Discovered	18.1	6.1	2.4	3.3	36.2	30.6	0.0	0.0	0.0	2.3	99
Total resource (BBOE)		45.6	54.5	6.1	28.7	80.9	234.6	2.2	45.8	0.3	25.4	525

Source: National Petroleum Council

CHALLENGES FACING ARCTIC OIL AND GAS DEVELOPMENT

Exploration and Development

The Arctic region presents many challenges for companies seeking to explore and develop oil and gas resources. These challenges all add to the cost of development and affect the speed with which resources can be brought into production. Companies must contend with cold, darkness for half the year, long supply lines, limited support facilities, long distances to markets, and, perhaps most challenging for the fields to be developed in the future, the presence of ice in the offshore Arctic waters, which contain the bulk of the remaining undiscovered resources.

Ice-related issues affect all aspects of the exploration and development processes. The National Petroleum Council identified three main groups of issues related to ice: ice type and abundance, length of open season, and water depth. Ice can take a number of forms including landfast ice, pack ice and drifting pack ice, and icebergs. The different types of ice create different conditions for exploration and production activities. Vessels and structures must be designed to withstand the pressures created by different ice forms. The length of the open season will be critical in determining the exploration period and the overall length of time required to evaluate a potential reservoir. Water depth becomes important for the type of structure that must be built for the production period in ice-prone areas. In shallower waters, to 100 meters (m), structures that are built on the sea bottom (bottomfast) may prove to be feasible for development. Deeper waters will require different types of facilities including floating platforms and subsea completions. Deeper water in areas of greater ice will require further development of technologies to bring fields into production. In regions prone to icebergs, flowlines and pipelines will need to be buried or protected in some way from the ice scouring of the ocean floor.

The types of ice and ice coverage vary widely across the Arctic region. The extent of ice coverage in the Arctic has been decreasing, especially in summer, but winter ice coverage is still extensive. Figure IV.8 shows ice-coverage minimum for 2014 and maximum for 2015.[21] At minimum levels, much of the Arctic Ocean is open for exploration, development, and transport activities. During the winter, however, only the Barents Sea area is free of ice. For exploration in the Barents Sea, the lack of ice coverage will be important in lowering the cost of exploration in coastal areas off northern Norway and Northwestern Russia.

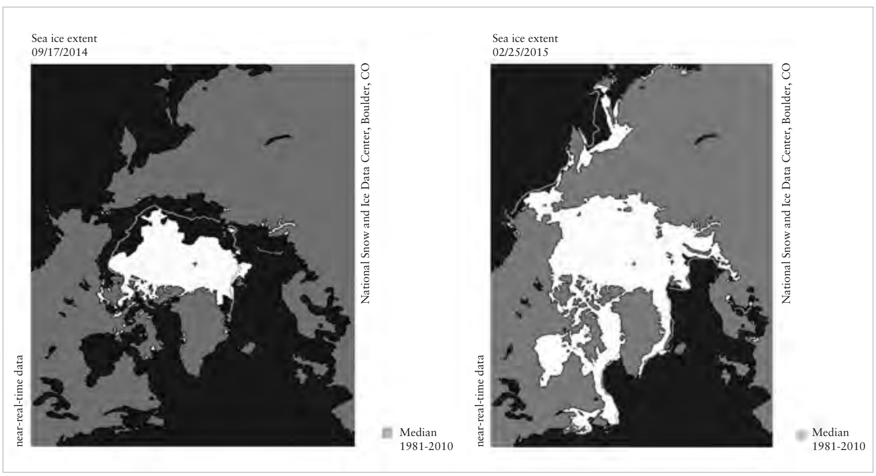


Figure IV. 8 Minimum 2014 and Maximum 2015 Ice Cover

Environmental Concerns

One key issue that has dominated the debate about Arctic oil and gas development is the ability to respond to a major accident resulting in oil discharge into the water. The Deepwater Horizon accident and spill in 2010 has become the benchmark for evaluating the risks associated with offshore drilling. While a containment system was devised to stop the discharge of oil into the ocean, a relief well was drilled to completely contain the well. The need to drill a relief well to fully contain the oil discharge from that accident has resulted in a requirement by the United States and Canada that companies must have this capability available while drilling in the Arctic offshore. The drilling season must accommodate the risk of needing to drill a relief well to respond to an out-of-control well. In the US Arctic, a relief well can take about forty days to drill, which means the exploratory drilling season has to be reduced by this amount to meet the requirement.

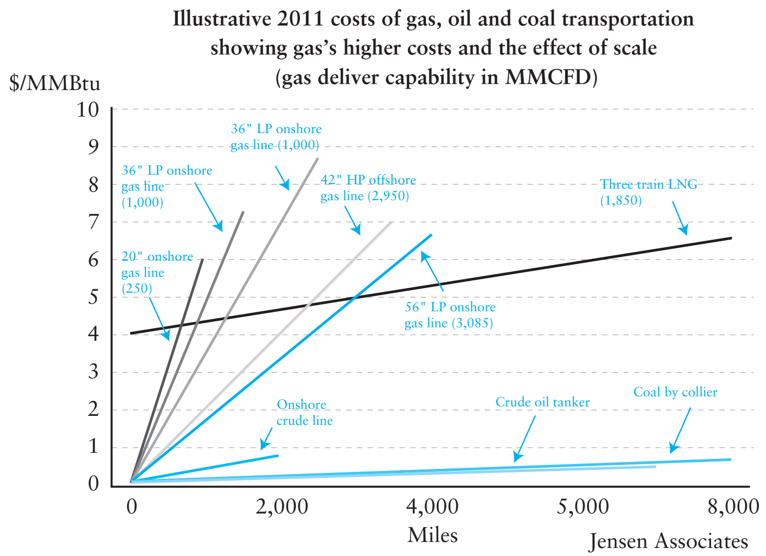
The NPC study concluded that while the conditions in the Arctic are difficult, the oil and gas industry has demonstrated the capability to operate safely in the region. Extensive onshore development has taken place in the Arctic since the 1960s and 1970s in Canada, Russia, and the United States. Offshore development has generally been limited to near-shore areas but industry has the technology to move further offshore. Additional technological research will be helpful in a number of areas including development of more resilient offshore structures, better knowledge of ice movements, and production systems capable of operating in deeper Arctic waters with limited or no open water periods.[22] The NPC report also concluded that existing technology, such as the capping system used in the Deepwater Horizon accident, would be as safe as a relief well capability and could significantly increase the drilling season. Oil-spill clean-up technology for use in the Arctic is essentially the same as that used elsewhere, i.e., mechanical recovery, burning, and dispersants. Concerns have been raised that these will not be adequate for oil-spill clean up in the Arctic.

While technological challenges for industry remain, the principal impact of dealing with Arctic conditions, especially ice, is that the total process for exploration, field delineation, and installation of production facilities will take significantly longer than field development in non-Arctic areas. Problems arising from remoteness and a lack of local infrastructure are faced by many development prospects in other parts of the world, but ice is the unique feature for the Arctic. Putting in place the necessary support infrastructure adds expenses as well as time in the development process, though once established this infrastructure should be able to support future operations. Mobilizing and demobilizing will add cost and time to the exploration process as will design and installation of ice-resistant production systems. The longer time necessary to reach commercial production has perhaps the greatest impact on the economic returns from a project. A long delay in earning income from such a large investment significantly reduces the net present value of these projects. The NPC estimates that, under current rules, the time from initiation of exploration to first commercial production in the Alaska offshore could range from eighteen years for shallow fields up to thirty-five years for deeper fields. In contrast, deepwater projects in the Gulf of Mexico take about ten to twelve years to get to commercial development.[23]

Transportation

A key issue for Arctic oil and gas development is the ability to ship any discovered resources to market cost effectively. The construction of the Trans-Alaska Oil Pipeline was critical for the commercial development of the giant Prudhoe Bay field in Alaska. Similarly construction of pipelines from the Yamal Peninsula in Russia to European markets has made possible commercial development of gas fields in the Russian Arctic. In other cases, large proved reserves have been stranded by the lack of infrastructure. The gas resources associated with the Prudhoe Bay field and in the McKenzie Valley of northern Canada are prime examples of stranded resources. Whether a resource is developed or stranded will be determined by a number of factors including the size of the resource, the choice between pipeline and shipping, and, perhaps most important, whether it is oil or gas.

Figure IV.9, developed by leading gas market analyst James Jensen, illustrates the relative costs of shipping oil and gas by tanker or by pipeline. While not specific to the Arctic, these figures give an overview of the impact of distance in the choice of shipping methods as well as size of pipelines. For oil, the cost of shipping is relatively low especially when tankers can be used. Even in difficult areas, cost should not significantly constrain development of new fields.[24] For natural gas, transport costs are much higher relative to the value of the resource. Shipping gas by pipelines requires compressor stations, while shipping in the form of LNG requires plants to liquefy the gas, specialized cryogenic tankers, and regasification



Source: Presentation by James Jensen, Jensen Associates

Figure IV. 9 Illustrative 2011 Costs of Gas, Oil, and Coal Transportation

facilities. In a market where the gas may be sold at USD 10–15/million British Thermal Units (mmbtu), LNG liquefaction and shipping costs of USD 4–8/mmbtu (and perhaps higher for Arctic projects) will be critical determinants of the economic viability of a project.

For Arctic-gas projects, shipping cost will be a crucial consideration. For LNG projects, distance will increase the number of tankers required to maintain a constant flow of gas from the LNG liquefaction plants to customers. Unlike oil tankers, LNG carriers are predominantly built to service specific projects with the number of tankers based on the specific routes. While this traditional approach is changing with the increasing size of the LNG tanker fleet, the availability of an adequate number of tankers is still a key concern.

CURRENT OIL AND NATURAL GAS ACTIVITIES IN THE ARCTIC

A number of offshore oil and gas exploration and development projects are underway in the Arctic that highlight the different conditions that will need to be addressed. In addition, several LNG projects are in operation, under construction, or in development that illustrate the challenges of marketing Arctic natural gas.

The Prirazlomnoye oilfield in the Pechora Sea, the first offshore development above the Arctic circle, came on line in 2013 more than twenty years after discovery. The production platform is located in 20 m of water about 80 kilometers (km) offshore and uses a bottom-fast structure specially designed to withstand ice. Production will reach 120 thousand barrels/day (mb/d). Oil is stored in the platform's base and offloaded into shuttle tankers and taken to a floating oil storage facility near Murmansk.[25]

The Goliat field in the Norwegian Barents Sea came into production in 2016 sixteen years after discovery. The production platform is a floating concrete structure in 400 m water depth, which is ice-free year round. Production is expected to reach 100 mb/d. The platform is 80 km from shore and produced oil will be stored in the structure and loaded directly into tankers to be taken to market.

Shell has invested about USD 7 billion since acquiring leases in 2008 and hopes to drill its first exploratory well in the Chukchi Sea this summer. A key element of Shell's exploration campaign was to have an oil-spill response capability available during the drilling season. The main components of the response capacity were a spill-containment device and a drill ship available to drill a relief well. The freeze up in the Chukchi Sea comes around 1 November so Shell needed to end its drilling in late September to meet the new environmental requirements. In September, 2015, Shell announced that it would end exploration work in the Chukchi due to disappointing results obtained from the wells drilled during the summer.

Exxon and Rosneft have drilled one well in the Kara Sea under an agreement reached in 2012. This well, completed just before imposition of sanctions by the US government and estimated to have cost USD 600–700 million, is one of the most expensive wells in the history of the industry. While the presence of hydrocarbons was confirmed, initial indications are that the area may be gas prone, which would severely undercut the possibility of commercial development.[26]

The first Arctic LNG plant was built in Norway to deliver gas from the Snøhvit field to United States and subsequently European and other customers and started operating in 2007. These markets are relatively close to the Snøhvit field and the project is located in an ice-free area of the Arctic, which helped to make it viable. The Snøhvit project also demonstrated the potential for the use of subsea completions with tie-back to shore-based facilities.

The search for a transportation system for the large Alaska North Slope gas resource has been underway for nearly forty years. The original route, selected and approved in 1977, would have taken the gas by pipeline to the continental United States. However, a decline in the price of gas undercut the economics of this proposal. In the early 2000s, higher gas prices and state of Alaska financial support revived the concept only to have shale gas production reduce prices well below a commercially viable level. Currently the state of Alaska and several companies are advancing a plan to pipeline the gas to the south of Alaska and convert it to LNG for sale to the high-value Asian market. The project has been estimated to cost about USD 45–65 billion, deliver twenty million metric tons (2.5bcf/d), and will require firm purchase agreements and oil-linked pricing to be viable.[27] Success in building this pipeline/LNG project will be critical to the commercial viability of any gas fields discovered in the Alaskan Arctic.

Russia is building a major LNG facility (Yamal LNG, located on Ob Bay) to export natural gas from the Yamal Peninsula. The project has a design capacity of 16.5 million metric tons and an estimated cost of USD 27 billion. The project partners are Novatek, a private Russian company; the China National Petroleum Company (CNPC); Total, a French international oil company and the Silk Road Fund, a Chinese government owned investment fund. To serve Chinese and other Asian markets, the Yamal LNG sponsors will utilize the Northern Sea Route in the Russian sector of the Arctic Ocean. This route will be available for about five months of the year. At other times, the LNG will have to be sent to European markets where prices would be lower or to Asia via the much longer route (possibly 5,000 nautical miles longer) through the Suez Canal. Specially designed ice-strengthened LNG tankers are being built for the project. The Yamal LNG project benefits from, and is likely dependent on, access to less expensive and developed onshore gas and from major support from the Russian government in the construction of infrastructure at the port, exemption from most taxes, and financial aid in creating the ice-strengthened LNG tanker fleet.[28]

Since the drop in oil prices in 2014, oil companies have been carefully reconsidering their investment options and have announced reductions in plans for the Arctic. The Financial Times (London) reported on the status of exploration in the Arctic. Several major companies have relinquished leases and decided to end exploration projects in Greenland because of limited exploratory success. Statoil's planned exploratory work in Norway's Arctic is being cut as a result of lower prices. Another Norwegian complex of oilfields, the Johan Castberg field, has been discovered but plans to develop it have been put on hold due to high costs. It also appears that Russian companies are postponing additional investments in the Arctic at this point.[29] Chevron has decided against exploration in the Beaufort Sea in the Canadian Arctic, and recently Exxon Mobil and BP (formerly British Petroleum) announced they would suspend exploratory drilling in the Canadian Beaufort unless their leases were extended.[30]

GEOPOLITICAL CHALLENGES IN ARCTIC OIL AND GAS DEVELOPMENT

Development of Arctic oil and gas resources has been long discussed in geopolitical terms. The establishment of extended economic zones under the United Nations Convention on the Law of the Sea (UNCLOS) has been connected with access to oil and gas resources. In the United States, supporters of ratification of UNCLOS have put forward the argument that if the United States does not quickly ratify the treaty, other Arctic nations (and perhaps non-Arctic countries) could take oil and gas resources that could be claimed by the United States. This argument is made despite the fact that the bulk of the resources currently identified fall within current economic zones.

The geopolitical issue that has the most direct impact on Arctic development at this time is the response of United States and Europe to Russia's annexation of the Crimea and support for separatists in Ukraine. To put pressure on Russia to change its behavior in Ukraine, the United States and Europe have imposed increasingly strong sanctions. In September 2014, the United States announced sanctions specifically targeting Russia's ability to develop oil and gas in deepwater, shale oil, and the Arctic. These sanctions, also adopted by the European Union, prohibit western companies from transferring technology or partnering with the five largest Russian oil and gas companies in development in these areas.[31] Exxon has been most directly affected by these new sanctions, as it has been required to stop work with

Rosneft on a USD 500 billion joint venture agreement to explore for oil and gas in the Arctic as well as the Black Sea and North America.

Novatek, sponsor of the Yamal LNG, had been included in earlier sanctions that would limit financial relationships. These sanctions could make financing of the project more difficult for the LNG facility. The Russian government has made clear that it will continue to support oil and gas development and is committed to supporting projects like Yamal LNG. Total believes that it will be able to secure financing in Europe. In addition, financing from China may offset the loss of Western financing.[32]

It is too early to be able to determine whether these sanctions will seriously inhibit Russia's ability to develop offshore Arctic resources because of uncertainty regarding how long the sanctions will be in place and whether they will be applied in a coordinated manner. Reports have indicated that differences in the way the sanctions are being applied have already resulted in some European companies continuing work and reaching new agreements with Russia.[33]

Russia treats both the Arctic and the energy sector as key strategic interests. The energy sector is the key element of the economy and of government revenue. The Arctic represents a large frontier area that offers development opportunities as well as being militarily important. The Russian government has said it will use its foreign-reserve holdings to help finance development and turn to other countries, especially China, for assistance in technology and financing. The Russian government has also revised the tax code so that any development in the Arctic would be subject to significantly lower taxes than those paid by the petroleum industry in the rest of the country.[34]

Russia's effort to build a stronger energy relationship with China has been accelerated by pressure from the United States and Europe. Before the Ukraine crisis Russia recognized that Europe's push to diversify gas imports and reduce the levels of Russian gas imports, combined with weak European demand, could lead to vulnerability for their export market. Opening stronger energy ties with China, the fastest growing energy consumer, is important to maintaining and expanding Russia's energy exports. The confrontation with the West over Ukraine has reinforced this policy. After many years of negotiations and numerous agreements, Russia and China finally completed negotiations in 2014 to build a natural gas pipeline into eastern China. This was followed by an initial agreement on a natural gas pipeline into western China. As a part of this growing energy-based relationship, CNPC, have been granted greater access for investment in the Russian energy sector.

A nontraditional form of geopolitical risk has been the growth of organized environmental resistance to Arctic oil and gas development. Arctic oil and gas exploration and development have been met with broad resistance from environmental groups and indigenous communities. Concern about damaging the fragile and largely unspoiled environment in the Arctic has provided a rallying point for environmental resistance. In addition, these groups point to the irony that recent melting in the Arctic caused by climate change may allow the production and use of additional fossil fuels.

Indigenous communities fear a loss of traditional lifestyles as the industrial presence of the oil industry changes the nature of communities. They also fear that the work offshore will harm the marine mammals and other wildlife that are important in this lifestyle.

Some of the environmental resistance has been coordinated across national boundaries. Greenpeace has waged a high-profile Arctic campaign in several countries where oil and gas drilling is being planned. They have boarded platforms and used other methods to attract international attention to their cause.

In individual countries, environmental groups and indigenous communities have used the regulatory and legal system to slow down and try to stop oil exploration and development. Shell's effort to drill in the Alaskan outer continental shelf (OCS) were slowed by numerous suits challenging government decisions at many levels. In Canada, indigenous groups have resisted plans to start preliminary seismic work and exploratory drilling in the Arctic.

Whether these efforts will stop drilling activities is uncertain. But adding additional time to exploratory drilling will affect the economics of project development. For companies, continued environmental resistance can also have a reputational risk. This will have to be considered in evaluating how large an investment to make in Arctic exploration and development.

CONCLUSIONS

Shale gas and tight oil have transformed the oil and natural gas market.

The supply curve for both has been extended in the middle and become more elastic. Oil demand has experienced a structural shift downward with policies mandating greater fuel efficiency and cleaner air. As a result, oil prices fell from an average of $93 in 2014 to an estimated average of about $35 in 2016. Predictions of the future price path of oil have also been lowered.

Arctic oil and natural gas resources are potentially quite large but the operating conditions, remoteness, and distance from markets pose significant challenges. These challenges will likely make oil and gas projects in the Arctic among the most expensive in the world with the longest lead times. A world with greater supply options, weak demand, and lower prices, could seriously hurt the perceived profitability of Arctic oil and gas projects. The petroleum industry has pulled back on the level of exploratory work and will wait until the market sorts out. It is possible that some areas, especially those with the biggest technical, cost, and delivery challenges, may go undeveloped. Some large oil discoveries, especially in ice-free or limited-ice regions, may go forward even at these lower prices. Gas projects are likely to be extremely difficult given the higher project cost and transportation cost of gas. This is particularly important since the initial resource evaluation indicates that the Arctic is expected to be highly prone to natural gas.

Governments may choose to improve the economics of oil and gas development through fiscal advantages or investment in some critical infrastructure. Russia's infrastructure investments and tax benefits for the Yamal LNG project, along with special tax treatment for other Arctic areas, is one example of a choice to support Arctic resource development.

Geopolitics will also play a role in the pace and scale of eventual development of Arctic resources. The sanctions on technology and finance for Russian Arctic development may, if maintained, slow projects for a few years until Russia builds its own capabilities and finds other financing sources. These sanctions have also been supportive of building a stronger Russia-China relationship in the energy area, and perhaps on a broader basis.

Arctic development is likely to be affected also by the level of environmental and indigenous opposition. In the United States, the sense of urgency to develop Arctic oil and gas is less strong than in previous years and environmental-review processes are more effective in slowing the pace of new drilling.

Perhaps the most important determinant of the pace and scope of oil and gas activities in the Arctic will be decisions made in December 2015 in Paris and in later negotiations on a global approach to controlling the level of carbon dioxide (CO_2) and other greenhouses gases. Implementation of effective policies to reduce the growth in greenhouse gas emissions and ultimately will dramatically change the future demand for fossil fuels, especially oil and coal. Demand for oil could peak and then begin to decline over the next several decades. Lower levels of demand for oil could be met with existing conventional and unconventional resources without the need to intensively develop the Arctic.

Notes

1. National Petroleum Council, *Facing the Hard Truths About Energy: A Comprehensive View of Oil and Gas*, 2007.
2. BP Statistical Review of World Energy 2015.
3. This evaluation covered global shale deposits and did not include oil resources that may be found in other tight formations. Also the assessment did not include fields in the Middle East which could also include significant resources.
4. *Technically Recoverable Shale Oil and Shale Gas Resources: An Assessment of 137 Shale Formations in 41 Countries Outside the United States*, Energy Information Administration, 10 June 2013.
5. BP Statistical Review 2015.
6. International Energy Agency, World Energy Outlook 2014.
7. E&E News, 28 March 2015, "Forget 'Peak Oil.' Is the World's Economy Heading Toward 'Peak Demand'?" http://www.eenews.net/energywire/stories/1060019207/search?keyword=peak+demand
8. Statoil, *Energy Perspectives: Long Term Macro and Energy Market Outlook*, June 2015.
9. Citi Research, "Shale and OPEC Can Grow in a Sub-$70/bbl World, but non-Shale/non-OPEC May Falter: Majors Underexposed to Shale," 5 May 2015. https://www.citivelocity.com/rendition/eppublic/documentService/dXNlcl9pZD1lc3djX0hEUG94T0k2X3dyVjFiOUt3JmFsPTlUc0Q4Y1YyckpRb2plclpWWkh5UmRtbHBJU3NmMk05VTZ2aDB6M1glMkIlMkZ1VkFxbUx3SVBXVXclM0QlM0Q/ZG9jX2lkPTU4MTc5NyZwdWJJZD0yMjU5NjA3JmFzc2V0Q2xhc3M9Q09NTU9ESVRJRVMmY2hhbm5lbD1EQ00mc3ViLWNoYW5uZWw9RW1ha

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10. IEA, *Resources to Reserves 2013*. It should be noted that the estimates of ultimately recoverable resources for new exploration areas or where new technologies are applied are likely to change, perhaps significantly, over time. The tight oil estimate is about two-thirds the level of an earlier EIA estimate.
11. The availability of excess LNG capacity was critical for Japan for power generation in the post-Fukushima period when all nuclear reactors were closed.
12. http://energy.gov/sites/prod/files/2015/05/f22/Summary%20of%20LNG%20Export%20Applications.pdf. Accessed on 8 June 2015.
13. http://energy.gov/fe/downloads/alaska-lng-project-llc-14-96-lng.
14. FGE Energy Estimate, April 2015.
15. Energy Information Administration, *Annual Energy Outlook 2015*, April 2015, 22.
16. In terms of million metric tons (mmt) of LNG this is 2.0 mmt, 7.5 mmt, and 18 mmt for the three cases.
17. *Circum-Arctic Resource Appraisal: Estimates of the Undiscovered Oil and Gas North of the Arctic Circle*, United States Geological Survey, 2008.
18. At 95 percent confidence level the estimate for the resources were 44 billion barrels and 770 trillion feet of natural gas while at 5 percent confidence level, 157 billion barrels of oil and 2,900 trillion feet of natural gas.
19. As an example, the USGS originally estimated recoverable resources for the National Petroleum Reserve in Alaska at about 10 billion barrels of oil but, after initial drilling, the estimate was lowered to 1.6 billion barrels.
20. National Petroleum Council, *Arctic Potential: Realizing the Promise of U. S. Arctic Oil and Gas Potential*, March 2015.
21. National Snow and Ice Data Center. http://nsidc.org/arcticseaicenews/files/2014/09/Figure12 and http://nsidc.org/arcticseaicenews/2015/03/2015-maximum-lowest-on-record/png. Accessed 12 June 2015.
22. NPC study, Part One.
23. NPC, Volume 1, 2–7.
24. A USD 60/barrel is equivalent to USD 10/mmbtu and at USD 100/barrel it is about USD 17/mmbtu with shipping costs below USD 1.00/mmbtu.
25. Oxford Institute for Energy Studies, *The Prospects and Challenges for Arctic Oil Development*, October 2014.
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31. "Obama May Have Just Dealt A Crushing Blow To Russia's Oil Exploration," *Business Insider*, 12 September 2014. http://www.businessinsider.com/us-sanctions-russian-oil-exploration-2014-9#ixzz3d9ansxpb
32. "Russia's Yamal Gas Megaplan to Become Symbol of Sanctions Defiance," Euractive.com. 19 September 2015. www.euractiv.com/sections/global-europe/russias-yamal-gas-megaplan-become-symbol-sanctions-defiance-308570.
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34. Oxford Institute for Energy Studies, "The Prospects and Challenges for Arctic Oil Development," October 2014.

Commentary

Arild Moe

Arctic development cannot be seen in isolation from overarching global trends. We are often reminded about this basic insight, but it is nevertheless easy to forget in studies and analyses with a regional focus. Pumphrey's article recognizes this point. It contains a comprehensive discussion of world energy trends with significant impact on Arctic energy development. He points out how the overall resource picture has changed because of the rapid growth in availability of unconventional oil and gas and also how new industrial opportunities are opening up in places other than the Arctic.

Developments now differ from the prevalent expectations only some seven years ago. At that time the widely cited—and misinterpreted[1]—resource assessments from the Unites States Geological Survey seemed to indicate that Arctic petroleum resources would become important in the not-so-distant future. This conclusion was supported by the observation that the international oil industry lacked access and investment opportunities in traditional producing regions.

But the surge in Arctic petroleum activity did not take place, for reasons Pumphrey identifies clearly. In addition to market developments, the cost of Arctic operations increased more than elsewhere, due to stricter environmental standards as well as precautionary steps by the industry after the 2010 Deepwater Horizon catastrophe. The slowing of Arctic, particular offshore, petroleum development was evident well before the fall in oil prices in 2014.[2]

The fall in the oil price, of course, also had major impact. But this impact has been indirect, since today's oil price is irrelevant for the profitability of new investments in the Arctic. The lead time (i.e. the time from when project planning starts up until a field starts producing) for many Arctic projects is long, even if not necessarily as long as quoted in Pumphrey's article. But fifteen years is a realistic minimum timeframe for many field developments. This means that profitability is determined by the price at that point in time as well as over the whole lifetime of a project, which may be twenty-five to forty years. That is why the link between exploration activity and the oil price is not so strong as long as the price fluctuates within a narrow band (see Figure IV.10 showing the relationship between oil price and spudded exploration wells on the Norwegian continental shelf). But a rapid decrease, as experienced in 2014, is something else. The falling oil price has had an immediate impact on Arctic exploration. This is because the cash flow of the companies is being hit. Their financial situation has deteriorated, and they cut costs across the board including investments in exploration. High cost programs with a long time horizon are natural targets. The effect is evident: Arctic developments are slowing down.

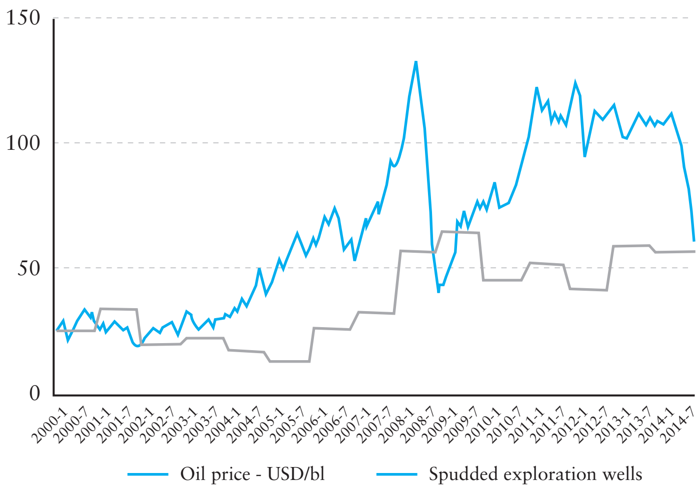
However, as we also often remind ourselves, the Arctic is a heterogeneous region climatically and socially, and it includes areas under many different jurisdictions. So, we should ask if there are particular projects or sub-regions in the Arctic where the logic referred to above does not apply or applies with less strength. For one thing, companies differ. Some companies may have better financial situations than others and be less inclined to cut exploration. Some companies may put a premium on acquiring new reserves, even if they are expensive. And some projects may be too far advanced to stop, even if the commercial assumptions have changed. Important also are the policies of the resource owners, the states in the Arctic. Their interest in, or dependence on, Arctic resource development affects the framework conditions and incentives given to the industry. This commentary will focus on offshore petroleum activities in two of the Arctic coastal states, Norway and Russia.

NORWAY

In Norway, petroleum activities have gradually moved northwards after production started in the North Sea in the early 1970s. But development of Norway's Arctic continental shelf in the Barents Sea was held back both because the oil industry was not convinced that the Western Barents Sea was resource rich and because policies were ambiguous. There was strong opposition on the ground that petroleum activities might harm the important fisheries in the area. In 2001, a ban on all new exploration activities in the Norwegian Barents Sea was imposed. This issue was resolved to a considerable extent through the introduction of special environmental provisions and protected areas. The ban was lifted, first partly and then fully, in 2010. The industry was not convinced, however, despite the discovery of the Goliat oil field in 2000.

A major goal of the authorities was to sustain the activity level in the petroleum sector after Norwegian oil production peaked in 2001 (see Figure IV.10). Announcing licensing rounds on Norway's Arctic continental shelf has been an instrument in this respect. Some exploratory drilling took place, but it was only in 2011 and 2012 that significant discoveries made the industry regain interest in the Barents Sea. At about the same time, in 2010, the long-lasting dispute between Russia and Norway over the delimitation of the Barents Sea continental shelf was solved, effectively making a new area of some 87 thousand square kilometers (km^2) available for exploration on the Norwegian side. A licensing round in 2013 attracted considerable interest.

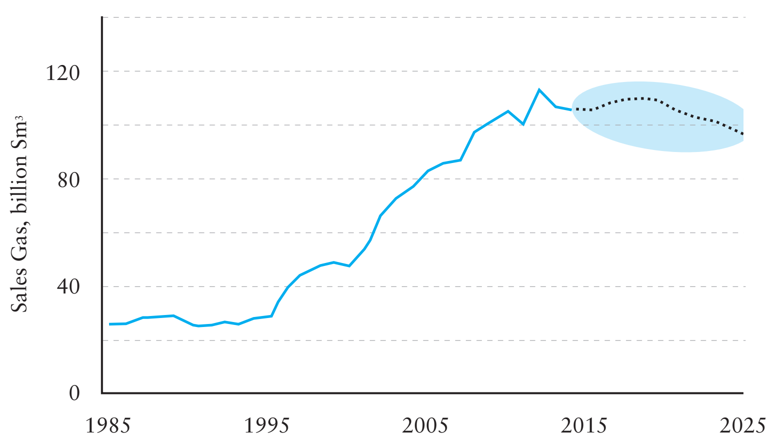
The twenty-third licensing round was announced in January 2015. It included fifty-four blocks in the Barents Sea, thirty-four located in the previously disputed area. This followed seismic surveying in the area carried out by the Norwegian Petroleum Directorate. Forty companies had nominated blocks for this licensing round, but licenses will be awarded only in 2016, and it is too early to tell conclusively if the new situation in the oil market will limit the interest. But it should be recalled that the Norwegian tax rules allow the companies to deduct exploration costs from



Source: Norwegian Ministry of Petroleum and Energy

Figure IV.10 Relationship Between Oil Price and Spudded Exploration Wells on the Norwegian Continental Shelf, 2000–14 their income elsewhere in Norway. This means that the state effectively covers 80 percent of the costs, a major incentive for exploration. Also important is that when a license is awarded to a group of companies, it will still take time before big expenditures are incurred (i.e., until exploration drilling starts). Until then, the license owner will be busy with relatively inexpensive seismic surveying and thus have some time to see if the outlook in the oil market improves.

There were doubts about the profitability of Arctic offshore projects earlier, too. Even in happier days, around 2002, development of the Snøhvit (Snow White) gas field, with recoverable reserves of 218 billion cubic meters (m^3) and peak production of about 6 billion, required special depreciation allowances to go forward. The project has seen significant cost overruns, with almost doubling of costs since the investment decision was taken. Plans for extending the liquefied natural gas (LNG) plant in Hammerfest with a new LNG train (compressor units to convert natural gas into Liquefied Natural Gas) were advanced when the license group headed by Statoil decided to cancel them in 2012. The reason cited was lack of gas to fill up the whole new liquefaction capacity.[3] But it seems likely that cost issues as well as market developments (see Figure IV.11) played a role. The companies in the license are now looking into increasing the capacity of train one of the project and also extending its expected



Source: Norwegian Petroleum Directorate

Figure IV. 11 Historical and Expected Volumes of Gas Sales from Norwegian Fields, 1985–2025 lifetime.

When it comes to projects that have already started, the economic calculation will be different from exploration and new investments in production. Most of the costs have been sunk at a time when higher prices and expectations prevailed. The Goliat field, to be operated by Eni, was still not producing in 2015, but the oil platform is ready for start of production in 2016 and has, of course, no alternative use. Investment costs are estimated to be some USD 5.6 billion. Some analysts argue that the project needs an oil price of USD 95/barrel to break even[4] and that on average a price of USD 60/barrel is required in the Barents Sea.[5]

The view of Statoil is that today projects in the Barents Sea, such as the big Johan Castberg field, are not viable but that it is possible to reorganize the projects, cut costs, and introduce new technologies and standardized solutions that will make them commercially attractive in the future, even at a relatively low oil price.[6]

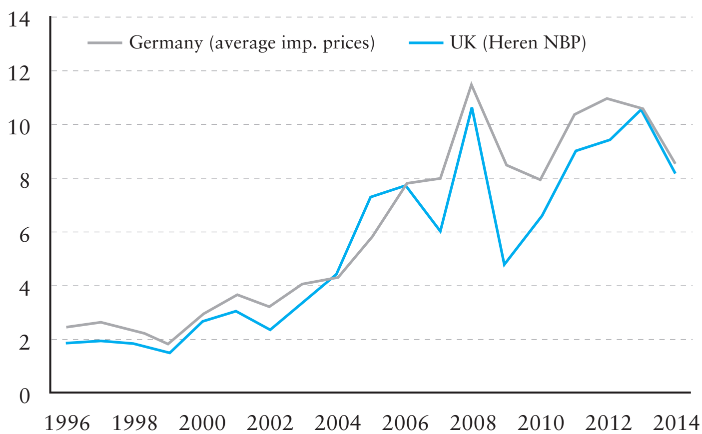
Development of Arctic petroleum has dimensions for Norway beyond a narrow commercial perspective. Norway is today the world's third largest natural gas exporter and supplies about 20 percent of the European market. This position is based on fields in the North and Norwegian Seas, connected to the European continent and Great Britain by an extensive pipeline system. But production from existing fields is now leveling off and will start to fall in some years, as shown in Figure IV.11. Thus, Norwegian output will be reduced from the early 2020s unless new discoveries are made. Because of the limited numbers of producers supplying gas to the European market on long-term contracts (still dominating despite an increasing share of spot gas), a long-term convincing commitment to supply the market is essential for Norway to retain its strong market position. Some new gas fields in the Norwegian Sea may be connected to the pipeline system but it is in the Barents Sea that big new gas discoveries are expected.

According to this reasoning, Norway should extend the pipeline system northwards to the Barents Sea to allow gas from that region to reach the market. The problem is, however, that such a pipeline would be costly and the oil companies will certainly not finance such a line before they have discovered sufficient resources and are certain that there will be a market for the gas. They have argued also in favor of LNG solutions for new gas, which will give them more flexibility. Thus, there is a certain conflict of interest between Norway, as a state, and the individual oil companies, including Statoil, which is 67 percent state owned.

The European gas market has developed in an unexpected way. Whereas the general expectation in Norway was that stricter climate regulations would favor more use of natural gas as the most climate-benign hydrocarbon, the simultaneous support for new renewable energy sources and energy conservation in a period marked by economic recession has actually reduced demand for gas in Europe. In 2014 consumption in the European Union fell for the third year in a row.[7] At the same time, new suppliers of LNG have emerged. This has led to a fall in gas prices creating uncertainty about the profitability of Arctic gas projects (see Figure IV.12).

It does not seem that the controversy about import of Russian gas to Europe is of any help to Norway. It is rather the other way around. Uncertainty about the prospects for one big supplier brings the whole gas market into question. Thus, it is in Norway's interest that Russian-European gas relations are stabilized, even if Norwegian exports have benefitted in the short term from reductions in Russian gas exports and inflexible Russian pricing.

Thus, the Norwegian government is faced with a double challenge. It needs to convince the market that Norway is a supplier for the long term and also to make it attractive for companies to invest in new gas projects in the Arctic. In practice, this probably means coming up with a scheme that makes it possible to finance a pipeline to the Barents Sea and develop



Source: Norwegian Ministry of Petroleum and Energy

Figure IV. 12 Natural Gas Prices in Nominal USD per mmbtu, 1985–2014 relatively high-cost Arctic gas to be mixed with low-cost North Sea gas and thus maintain the necessary export volumes.

There is also a Russian dimension to Norway's exploration program in the Arctic. According to the Norwegian-Russian delimitation treaty of 2010, eventual cross-border fields are to be unitized and developed on a cooperative basis. An argument in favor of exploration on the Norwegian side of the delimitation line now is that it is important to get a detailed picture of the resource situation on the Norwegian side before discussions with Russia start.

RUSSIA

Russia was long the world's number two oil producer and number one gas producer, until it was recently overtaken by the United States on both accounts. The petroleum industry plays a dominant role in the country's foreign trade as well as being a significant source of taxation. Russia has a huge onshore resource base, but it is underdeveloped and new fields are much smaller, more geologically complicated, and remotely located than in earlier times when both the oil and the gas industry could rely on giant fields in West Siberia.[8] The oil industry is plagued by a falling recovery rate.

The Arctic and especially the offshore Arctic has been touted as Russia's resource base for the twenty-first century. Geological indications of huge resources in big concentrations would seem to offer an attractive solution to Russia's search for new production capacity. Geological surveys have been carried out from the 1970s, and some exploration drilling from the 1980s. But the region has only really been promoted in policy documents since 2000. Nevertheless, development was slow. Whereas reference is often made to a total of 70 billion tons of oil equivalent on the Russian continental shelf, only 10 percent of this has actually been discovered. The biggest concentrations are in the Barents and Kara Seas and most of this is natural gas.

One important reason for the slow development is that the Arctic offshore presents a more pressing need for cooperation with foreign companies than the traditional onshore areas. This fact collides with a perception among Russian policy makers that the region is strategically important and that it is especially important to keep activities there tightly under Russian control. This view was reflected in the 2008 legislation that granted a monopoly on offshore operations to the state-dominated companies Rosneft and Gazprom, followed by generous licensing of offshore acreage to the same companies. But both Rosneft and Gazprom were busy onshore and had little or no offshore experience. They were not inclined to take big risks launching costly Arctic projects, despite exhortations from the Ministry of Natural Resources, which has a responsibility for resource development. With monopoly positions enshrined in law they could safely regard the Arctic offshore as a longer-term option. However, political pressure to see some developments offshore increased and a formula was eventually found in 2012 making it attractive for foreign companies to take minority positions in joint ventures with the Russian license holder, in practice Rosneft.

Russian Collaboration with Foreign Companies

Recent Russian offshore licensing practice involves huge areas, rather than selected blocks as the custom is elsewhere, and leaves resources management to the license holder. With the new framework in place Rosneft set out to explore these license areas with the help of foreign companies.

The first agreement was signed between Rosneft and BP for a license area in the Kara Sea. But this deal fell apart due to the conflict between BP and its Russian partners in TNK-BP, and the project was taken over by ExxonMobil. The final agreement was signed only in April 2012 after then Prime Minister Putin had promised substantial tax concessions (which were written into law in the autumn of 2013). Shortly after that, Rosneft signed deals with Eni to explore and subsequently develop resources in the southern part of the previously disputed area with Norway in the Barents Sea. A few weeks later, a similar agreement was made with Statoil for the northern part of the Barents Sea, as well as for three blocks in the Okhotsk Sea. In 2013, the agreement with ExxonMobil was extended to include licenses further east in the Kara Sea as well as in the Laptev and Chukchi Seas. Altogether, about 850,000 km^2 of Russian Arctic offshore acreage is now included in these cooperation agreements, including 760,000 km^2 with ExxonMobil alone. The deals offered Rosneft a free ride for a few years, since the foreign partner would cover all the costs in the geological prospecting phase and for a certain number of exploration wells.

These deals also made it clear that Russia was dependent on experienced Western companies for development of its offshore resources, and the sanctions imposed following the crisis in Ukraine in 2014 seriously complicate the outlook for Russia's Arctic offshore projects. By September 2014, ExxonMobil was required to abandon the drilling campaign in the Kara Sea, before the scheduled end of season. This happened right after Rosneft announced that a promising discovery had been made. As long as the sanctions stand, development of the larger Arctic offshore projects will be retarded. It is indicative that no drilling in 2015 was announced in the big offshore projects in deeper waters. A comprehensive agreement between Rosneft, North Atlantic Drilling (NAD), and Seadrill has been put on hold. It would have involved Rosneft using six rigs until 2022 at a price of USD 4.25 billion and also acquiring a 30 percent share in NAD.

Rosneft is expected to continue seismic surveying, though, since Russia has its own capabilities for this activity. And cooperation with Western partners that does not involve transfer of technology under sanction continues, including drilling in non-Arctic waters that are not deepwater. (The US sanctions are stricter than the European ones in this respect.)[9]

The official Russian, and Rosneft, position is that the Western companies can be replaced by other, primarily Asian, oil companies and by domestic technology. But this seems unrealistic, since these companies do not possess the necessary experience and competence to operate in remote offshore areas. The question is also how these companies perceive their interest. The main Chinese approach to the Russian Arctic seems to be to provide finance and to obtain long-term supply contracts, not to venture into costly high-risk developments with their own technology.

But, in some smaller, shallow-water projects in the Pechora Sea, Asian companies are assuming a role. It was reported that Rosneft agreed, in 2013, to cooperate with the China National Petroleum Company to study three structures in the Barents Sea. Since then, it has been quiet, and the agreement was not included in a comprehensive list of cooperative activities between the two companies in 2014. A more concrete agreement was made in September 2014, when Rosneft entered into a partnership with PetroVietnam for the exploration and development of two blocks in the Pechora Sea, with estimated recoverable resources of 367 million tons. And Asian service companies are already on their way to Arctic projects.[10]

The Russian government has gone a long way toward making foreign investments in offshore activities attractive, and the fiscal framework for individual projects prioritized by the government seems negotiable. In

2015 serious proposals to lift the offshore monopoly held by Rosneft and Gazprom were being discussed by the government, reportedly with the support of President Putin. This would, first of all, affect other Russian oil companies such as Lukoil, but could also give foreign companies a better position after sanctions are lifted at some point. But 80 percent of fields on the continental shelf have already been licensed to Rosneft and Gazprom. The question is how attractive the remaining fields are. The first licensing that would test the government's resolve is the Murmanskoe gas field in the Barents Sea. The Minister of Natural resources believes that Lukoil, Zarubezhneft, and Gazprom Neft will be interested.[11] But the problems in the gas market are likely to affect calculations of profitability. In addition Gazprom's export monopoly will form a barrier. This barrier was overcome in the Yamal LNG project (see below). But it is not a given that new entrants will have the opportunity to export directly. Also, this project will depend on foreign cooperation.

The major Arctic petroleum development that is taking place in Russia is the Yamal LNG project. It is not an offshore project, since it has resources onshore on the eastern side of the Yamal peninsula. But since it is so tightly connected to maritime activities, it is natural to mention it in this discussion. The project was conceived, rather surprisingly, independently of Gazprom by Novatek, the largest non-Gazprom producer, but it really became dynamic when Gennadi Timchenko became an important shareholder in that company. Many observers attributed the success of the project to the close connection between Timchenko and Putin. But also Gazprom's unsuccessful LNG strategy may have led the government to let another producer develop a large project.

In any case there are strong political drivers behind the project. It fits very well into the Russian government's ambition to develop its Arctic region and, more directly, to establish a large, stable customer for the nuclear icebreaking fleet. As I have argued elsewhere, the most important part of the project is not the production and sales but the transportation.[12] The plan is to move the gas eastwards in the "summer" season and westwards in the winter, but mainly serving Asian markets all year.

A study of the economics of this project carried out by two Norwegian researchers for the International Institute for Sustainable Development showed that the project was not economical for the investors without substantial state subsidies, including infrastructure (the port of Sabetta) and various tax concessions.[13] This conclusion was reached before the fall in oil prices and the corresponding impact on LNG. But for the investors, which now include Total (20 percent), China National Petroleum Company (CNPC), 20 percent), the Chinese Silk Road Fund (9.9 percent) in addition to Novatek (50.1 percent), the project has been making sense. Obviously, they believe that the generous tax situation will continue. And they have reason to do so. The concessions given to the Chinese investors were written into a long-term government-to-government contract for transportation of gas. The shipping includes joint ventures of Chinese, Japanese, and Canadian shipping companies, but it was expected that the Russian state-owned company Sovcomflot would play the largest role, ordering six ships. Sovcomflot has, however, cut back on its order and is now buying three. This has forced Yamal LNG to establish its own shipping company to take care of the last three carriers. The reason is not entirely clear. Financial sanctions against Russian companies are believed to play a role but it is also possible that the commercial outlook now is such that six ships, at a cost of about USD 350 million each, would constitute too high an exposure.

In terms of volume, Yamal LNG is not the biggest story in Russian-Chinese energy trading. With a total output of 16.5 million tons per year, corresponding to some 22.5 billion (10^9) cubic meters (bcm), it is smaller than volumes contracted for pipeline exports to China, some 38 bcm with possibly another 30 bcm if the second, western, pipeline is realized. Besides, 2.1 million tons a year from Yamal LNG is destined for Spain, and some of Yamal LNG's output will probably go to Asian markets other than China.

All in all, even if Russia's ambitions for the Arctic remain on paper and the geological mapping of the continental shelf continues, it seems evident that all the big projects will have to be revisited for several reasons. The immediate problems caused by the Western sanctions are putting many projects on hold. In any case, the lower oil price will affect company interests, both Russian and foreign, if and when sanctions are lifted, in much the same way as it does elsewhere in the Arctic. In addition, for Western companies the political risk will linger even when the sanctions are lifted. Could new crises emerge? This will add to the already high commercial risk associated with offshore petroleum projects.

Much will also depend on the state of the Russian economy. Even if highly prioritized, the Russian government may not be able to offer the level of subsidies and tax benefits that is necessary to get Arctic projects under way. Some liberals see the ongoing economic crisis, which predates the Ukraine conflict, as an impetus to comprehensive economic reforms. Such reforms could ultimately shake up the whole economy and also affect the Arctic. However, at the moment, this scenario does not seem likely.

Notes

1. See Arild Moe, "Potential Arctic Oil and Gas Development: What are Realistic Expectations?," in *The Arctic in World Affairs: A North Pacific Dialogue on Arctic Marine Issues*, edited by Oran R. Young, Jong Deog Kim, and Yoon Hyung Kim (Seoul/Honolulu: Korea Maritime Institute/East-West Center, 2012), 231–54.
2. See e.g., Arild Moe and Svein Vigeland Rottem, "Offshore Petroleum and Maritime Infrastructure," in *The Arctic in World Affairs—A North Pacific Dialogue on International Cooperation in a Changing Arctic*, edited by Oran R. Young, Jong Deog Kim, Yoon Hyung Kim (Seoul: KMI Press, 2014), 23–40.
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12. Arild Moe, "The Northern Sea Route: Smooth Sailing Ahead?," *Strategic Analysis* 38, no. 6 (2014): 784–802.
13. Lars Petter Lunden and Daniel Fjaertoft, "Government Support to Upstream Oil and Gas in Russia: How Subsidies Influence the Yamal LNG and Prirazlomnoe Projects," The International Institute for Sustainable Development, 2014.

Commentary

Andrei Zagorski

INTRODUCTION

Progress in developing the natural resources of the Russian Arctic is more uncertain today than it was even two or three years ago. This is due to several developments, including those analyzed in Pumphrey's excellent article.[1] But the causes go beyond shifts in world energy markets. The development of Russia's Arctic resources is affected in a complex way by multiple factors. These include western sanctions introduced against Russia in the context of the Ukraine crisis, which have significantly limited access of major Russian state-owned energy companies to international equity markets and investment resources and relevant Western technologies and expertise. New partnerships Russian companies are seeking to forge around their Arctic projects, not least those involving companies from Northeast Asia and particularly from China, do not fill the gap that has occurred after a number of Western companies have suspended their participation. While western sanctions have added a new dimension to the issue, however, they are not the only reason for the slowdown of Russian activities in the Arctic.

To understand the complexity and the limits affecting the development of energy resources of the Russian Arctic, it is important to distinguish between the development of offshore deposits located or expected to be discovered in the marine Arctic and onshore deposits. Both are in the Arctic, but the accessibility, costs, and risks associated with the development of offshore and onshore resources in the region are fundamentally different.[2]

Prospects for the development of Russia's Arctic resources also differ significantly depending on the location of relevant deposits in the western and in the eastern parts of the Russian Arctic zone, particularly as the access and the capabilities for their transportation are different.

Finally, it is important to consider the relative importance of Arctic oil and gas for the pursuit of Russian politics. Most assessments indicate that Russian marine Arctic is richer in natural gas rather than in oil.[3] Apart from the fact that international gas markets differ significantly from those for oil, natural gas as a tradable commodity plays a secondary role in the Russian economy, which is based largely on export of oil and oil products. Therefore, the two commodities play different roles in the Russian energy strategy.

This commentary argues that, while global investments in energy development shifts from shelf to nonconventional and renewable projects, Russian companies are most likely to continue investing in the development of conventional gas and oil in the Arctic. In doing so, they will be following the traditional path of the Russian energy industry which is used to exploiting large, terrestrial, conventional hydrocarbon deposits. In the coming decades, investment is most likely to remain focused on developing *onshore gas and condensate fields in the western part of the Russian Arctic* (first of all, on the shores of the Kara Sea). Exploration in the marine Arctic will proceed, as it did before sanctions were introduced, at a slow pace in the western Arctic seas (Barents, Pechora, and Kara), while the *actual development of offshore fields in those areas will be postponed continually* for a variety of reasons.

The sanctions will be one reason for the delay due to the fact that western technology, equipment, and expertise cannot be replaced any time soon either by the advance of Russian domestic technologies or by developing cooperation with Chinese energy companies. Such a substitution takes place in a limited scope to the extent Chinese companies step into selected *onshore* projects as investors but, at the same time, keep away from being involved in *offshore* development.

As a result, the Russian government and the major energy companies may turn their eyes increasingly to previously neglected nonconventional sources, particularly tight oil in west Siberia, thus following major trends in the world markets. Still, this turn would not be easy as the withdrawal of the leading Western corporations would affect this development more than any projects in the marine Arctic.

MAJOR CHALLENGE TO RUSSIA: FORTHCOMING DECLINE OF OIL PRODUCTION

The interest of the Russian government in Arctic hydrocarbon resources is best understood in the context of the anticipated decline of oil production in its major oil province in Western Siberia, as the depletion of old fields is not compensated by the expansion of production in new provinces in that area. The decline is expected to become visible around 2020 unless significant new discoveries are made, and perhaps even earlier as a consequence of underinvestment due to current low oil prices coupled with the economic crisis in Russia and the effect of sanctions.

As a result, Russian oil exports, currently averaging 300 million tons/year, are expected to drop by about a third and then to stabilize at a level of 180–200 million tons/year in the years to come.[4] Bearing in mind that oil exports (crude and refined) are the single most important source of wealth in Russia and the major source for budget revenues, a decline of exports by a third will present a major challenge to the Russian state. It is not surprising that designing strategies to close or narrow the anticipated gap enjoys high priority in Russian politics.

The probability of discovering large new terrestrial deposits[5] in Russia is believed to be low,[6] as in the world in general.[7] This conclusion is supported by the results of explorations conducted in Russia over the past decade (2003–13). Although a total of 533 new deposits were discovered during that time, the reserves in new terrestrial fields are considered too small to attract much attention.[8]

Therefore, decisions being made in Russia are largely informed by the conclusion that shifting exploration from land to the *continental shelf* represents a major global trend. This appears particularly attractive and plausible for Russia as its Arctic shelf is considered to be well-endowed with energy resources.

A comparison of assessed resources of Russia's continental shelf areas clearly puts the Arctic into the leading position. Even though poorly explored, the shelf of the Russian Arctic seas is supposed to contain over 80 percent of technically recoverable resources (no less than 60 percent for oil and 84 percent for gas) of all Russian maritime areas. Two other areas of Russia's continental shelf prone of energy resources (the Sea of Okhotsk, with an estimated 32 percent of recoverable oil and 11 percent of gas resources, and the Caspian Sea, with 8 and 5 percent, respectively) remain clearly secondary.[9]

The predominant perception in Russia is that the hydrocarbon resources, including oil, natural gas, and condensate, on the Arctic continental shelf are huge and that they can make a difference for Russia as well as for global energy markets. The Arctic basin is seen as being, worldwide, the largest oil and gas province containing no less than 100 billion tons of conventional fuel.[10] Although, admittedly, less than 10 percent of this expected volume represents proven reserves,[11] Russian commentators picked up numbers from the 2008 United States Geological

Survey's Arctic assessment claiming that Arctic *undiscovered* deposits represented 25 percent of the world's total *undiscovered* energy resources. Those numbers were quickly turned into 25 percent of *total* world reserves.[12] Some Russian authors even go as far as to claim that the Arctic harbors some 30 percent of total world energy resources.[13]

Against this background, it is not surprising that official doctrines define the Arctic shelf as the long term "strategic" resource base of the Russian economy.[14] Official policies project the production of 40 to 80 million tons of oil in the Russian Arctic seas by 2030 (8–16 percent of the current level) and of 190–210 billion m^3 of natural gas (32–35 percent of the current levels).[15] These projections appear idealistic and subject to correction.[16] But even though most of publicized Russian assessments of the size and global importance of Arctic resources are highly inflated[17] and remain "speculative,"[18] they fit perfectly into the general policy discourse resting on the thesis that, sooner or later, Russia is destined to move onto the Arctic shelf for oil and natural gas.[19]

This is not to say that no alternative strategies to moving into the Arctic in order to compensate for the anticipated decline in production elsewhere are being discussed. In addition to increasing *natural gas* production,[20] an alternative strategy focuses on the development of *tight oil*, which is identified by some Russian experts[21] as a viable alternative to offshore projects on the Arctic shelf. Pumphrey's article seems to support this conclusion.[22] Proponents of this path point out several competitive advantages of tight oil extraction in Russia as compared to Arctic projects: it is not only less cost intensive and available in larger volumes, significant deposits also are supposed to be located in Western Siberia ("Bazhenovskaya svita") where the development can benefit from the existing transportation infrastructure.[23] The most optimistic projections go as far as to suggest that the production of tight oil in Western Siberia could grow from one million tons in 2013 to eighty million tons by 2030,[24] comparable to the most optimistic forecasts for production from the Arctic continental shelf.

Until recently, however, the Russian government largely neglected the potential for development of unconventional fuels.[25] This was due not least to the fact that many in the Russian energy industry, who got used to developing large and extra-large deposits of conventional fuels, remain skeptical, if not dismissive, and tend to regard unconventional resources as a short-lived and annoying phenomenon on the market.[26] With the lifespan of tight oil wells of some ten years, many Russian experts expect that, given the current low oil prices, the US shale revolution will shrink back, continuing with existing wells but adding many fewer wells in the future.[27]

LIMITATIONS AND PROSPECTS

Despite the apparent "Arctic pivot" and the prospect of continued limited government investment, the Russian energy industry remains pragmatic. It is aware not only of opportunities, but also of risks and limitations of moving further north and particularly into the marine Arctic.

Challenges to developing Arctic resources are much greater than in other parts of Russia. They range from extreme weather conditions and higher environmental risks to underdevelopment or total lack of required infrastructure and logistics for the transportation of extracted resources to markets, lack of labor and particularly of skilled labor, lack of expertise as well as of technologies to work offshore in the Arctic, and extremely high cost intensity of all Arctic projects.[28] The decision to limit access to the acquisition of licenses for the exploration and development of marine Arctic resources to two state-owned companies, Gazprom and Rosneft, further limits the ability to manage relevant risks[29] and is highly controversial within the expert community and the government itself.[30]

While many risks are believed to be manageable on the basis of technological advances and intensive international cooperation, extremely high costs of development and transportation of Arctic resources are believed to represent, in the medium- to long-term perspective, the major barrier to the exploration and extraction of energy offshore in the Arctic. Whether the market will become more favorable for Arctic offshore projects remains an open question.

High Development Cost

While the development of resources beyond the polar circle is generally cost intensive, offshore projects in the region are expected to be profitable only with a global oil price of USD 100/barrel or more.[31] Current prices are thus not encouraging to investment into offshore projects, to say the least. This is the background against which a recent statement by Rosneft CEO Igor Sechin should be interpreted, in which he projected a dramatic surge of the oil price to USD 175/barrel after 2025.[32] Whether or not this estimate is correct is less important. In a market environment that generally discourages investment into Arctic projects but also considering extremely long lead time for any project in the region, his underlying argument is that long-term investment decisions need to be made now despite the unfavorable situation in the market in the expectation that, in the longer run, such investments will pay off.

Comparative Disadvantages of Arctic Offshore Projects

Business decisions concerning the development of Arctic resources are made not only on the basis of calculations regarding whether or not investments will pay off. They are also made on the basis of estimated profitability of respective projects as compared with the expectations extended to similar development endeavors elsewhere. This is why even enthusiastic Russian projections ("Russia is doomed to move into the Arctic") depart from the conclusion that any proper development of offshore resources in the Arctic can only begin when associated costs become comparable with the growing cost at the depleting old fields in Western Siberia.[33] This is true not only with regard to comparative costs of developing resources in the Arctic and Western Siberia; it is also an important distinction between offshore and onshore development projects in the Arctic itself.

According to estimates of the Russian Research Institute of Oil Geology, with an oil price under USD 100/barrel and the current relatively favorable taxation regime and despite the general perception of the extreme hydrocarbon endowment of the Arctic shelf, less than 1 percent of the area's initially recoverable resources are classified as *highly profitable*. Even an oil price above USD 100/barrel and the introduction of tax abatements for shelf projects for seven-to-ten years would not make a big difference. *Onshore Arctic projects are expected to be twice as profitable as those offshore.*[34]

This is a reason why, while moving further north beyond the polar circle, Russian companies concentrate on onshore projects, mainly in the north of the Yamal Peninsula and, prospectively, on the nearby Gudym Peninsula.[35] Novatek's Yamal liquefied natural gas (LNG) project and the construction of the new port near the Sabetta settlement in the northeast of the Yamal Peninsula for the purpose of marine shipment of its production to international markets enjoy high priority. This is also a reason why Prirazlomnoye, a mid-size oilfield discovered in 1989 and located near the coast of the Pechora Sea at a depth of under twenty meters, launched in December 2013 after years of repeated delays, so far remains the single offshore development project implemented by Russian energy companies.

Lack of Shipping Opportunities

Cost of transportation, which is estimated to account for 60–80 percent of the total cost of the development of Arctic resources, both on and off shore,[36] but also an almost complete lack of adequate transport infrastructure remains a major barrier for the development of Arctic resources particularly in the eastern part of the Arctic zone of the Russian Federation. Resources from the Yamal Peninsula are supposed to be shipped to markets by sea, a solution available after year-round navigation in the Kara Sea became possible in the 1970s after the introduction of the nuclear-powered icebreaker fleet. The construction of three new nuclear-powered icebreakers, as well as of about a dozen diesel-electric icebreakers by 2020, is supposed to make year-round operation in the Kara Sea further possible in order to ensure marine shipment of resources extracted on the Yamal Peninsula. This is the main reason for the Russian government to invest in the icebreaker fleet.

Nevertheless, the option of year-round navigation in the eastern Arctic seas (Laptev, East Siberian, and Chukchi) is unlikely to become possible in the foreseeable future. This represents the most important barrier for the development of eventual resources in the eastern part of the Russian Arctic, both onshore and offshore, in the time to come. This is a reason why the exploration of the resources in the eastern Arctic seas is clearly lagging behind the low-level activities in the western Arctic seas. While a total of eighty-eight exploratory wells had been drilled in the western Arctic seas by 2015 (only one in 2011, none in 2012–13, and two in 2014),[37] the eastern Arctic seas so far remain virtually unexplored with no exploratory well drilled yet.

"Geopolitics"

Western sanctions, including those imposed on Russian energy projects in the Arctic, certainly do affect development, particularly of offshore projects. However, neither their immediate effect nor the possibilities to circumvent sanctions by expanding cooperation, particularly with Chinese companies, shall be overestimated. At the same time, they stimulate the Russian government to explore options, other than developing marine Arctic, which it neglected before.

What Russian companies were looking for in order to work in the Arctic was primarily investment resources, state of the art technologies, and northern expertise. While expertise for developing onshore resources and fields extending into shallow coastal waters is widely believed to be available and relevant technologies are supposed to be developed in Russia itself,[38] after fifty years of working in the north, limited access to equity markets has become a major problem for funding investment projects.[39] Restrictions on technology transfers (including on spare-parts supply) and suspension of partnerships with leading Western companies primarily hits offshore development projects.[40]

This certainly leads to further delays in exploration and development of the Russian marine Arctic. However, its pace was not fast before sanctions were introduced for reasons been discussed above. Rosneft has suspended exploratory drilling in the Kara Sea in 2015 after ExxonMobil ended its participation. But the exploration in the Kara Sea was anyway moving ahead at a very slow pace, despite the fact that the area is considered extremely promising. Development of offshore deposits discovered earlier was repeatedly postponed before sanctions were introduced due to high cost and uncertain market opportunities. The Shtokman field is the most prominent example.

At the same time, Russia remained keen to save its flagship onshore projects, such as Yamal LNG. The project was hit by financial sanctions since some 70 percent of the investment volume was supposed to be borrowed on financial markets.[41] But the deal engaging China National Petroleum Company (CNPC) and Chinese banks in funding the project was basically agreed before sanctions. The major difference after sanctions were introduced is that the Chinese partners finally agreed in 2015 that their financial contribution would go far beyond the 20 percent share of CNPC in the project and that they would take over the bulk of the funding.

Another example is the September 2015 agreement by the Indian Oil and Natural Gas Corporation Ltd (ONGC) to enter with 15 percent of the development of the Vankor field, an oil project in east Siberian Taymyr region operated by Rosneft,[42] while negotiations with CNPC on its eventual share in the development of this field continue.

The *engagement of Chinese companies, which is supposed to help* *circumvent the effect of Western sanctions, is limited to funding of onshore projects* in the Russian Arctic, such as Yamal LNG or, eventually, Vankor, while Chinese companies remain extremely hesitant about entering offshore projects in the Arctic lacking both expertise and relevant technologies.[43] Otherwise, most of the reports on expanding Russo-Chinese cooperation after sanctions have been introduced, such as the gas deal sealed in 2014, concern projects outside the Arctic region.

CONCLUSIONS

The enthusiasm with regard to expanding exploration and development of hydrocarbon resources further north, and particularly on the shelf areas of the Arctic seas, reached its peak by 2008 as oil prices were at their height. Even at that time, moving off the Arctic shore was not considered a near prospect. It was clear that Russian companies lacked financial resources, expertise, and relevant technologies while the costs and risks were high.

Current Western sanctions against Russia, reducing or banning access to relevant investment and technologies, further delay the movement of Russian companies onto the Arctic shelf, while the growing cooperation with Northeast Asia, and particularly with China, focuses on financing a few onshore projects and is unlikely to provide the required expertise or technologies to work off the northern shores. Most of the recently agreed Russia-Chinese joint projects keep out of the Arctic.

The most important bottom line for decisions by Russian companies to move onto the Arctic shelf is set by oil prices and the comparative costs of developing Arctic onshore oil and gas. As long as the oil price remains low and there remains room for further expanding more profitable development of terrestrial resources in the western part of the Russian Arctic, particularly on the shores of the Kara Sea, critical decisions to expand the work on the shelf are unlikely anytime soon despite the inertia of the earlier enthusiasm and regardless of how long Western sanctions persist.

Against this background, several decisions taken recently indicate that Russian businesses and government are beginning to reconsider options available for matching the forthcoming decline in oil production. More recently, the major players in the Russian energy sector (Rosneft, Gazprom-Neft, Surgutneftegaz, and Lukoil) have become increasingly engaged in exploring tight oil in Western Siberia. The Russian government, after a long period of resisting requests for tax relief on tight oil exploration, finally gave in by passing a law approved by the State Duma (Parliament) in July 2014.[44]

However, developing even promising deposits of tight oil might prove to be more vulnerable to sanctions in the near-term after all Russian companies relied on experience and technologies provided by their foreign partners, ExxonMobil, Shell, BP (formerly British Petroleum), and Total, respectively. After these companies had to withdraw from joint projects in 2015, their implementation gets increasingly stalled.

Apparently, this presses Russian companies further to reconsider their strategies and to scale down their ambitions particularly in the marine Arctic as well as those pertaining to tight oil resources. The adjusted strategy of Rosneft announced by its CEO Igor Sechin in August 2015 is the most recent example for this development. According to Sechin, until 2020, Rosneft is going to concentrate on new oilfields in east Siberia, gas production, and on increasing the efficiency of exploiting its existing fields,[45] all focused outside the Arctic.

Notes

1. David Pumphrey, "The Impact of Shifting World Energy Markets on Arctic Resource Development." Paper prepared for the 2015 NPAC.
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3. Elena Telegina, "Developing Natural Resources," in *Russia in a Polycentric World*, edited by A. A. Dynkin and N. I. Ivanova. (Moscow: Ves Mir, 2012), 81. NEEDS PUBLISHER
4. A. I. Tatarkin, ed., *Rossijskaya Arktika: Sovremennaya Paradigma Razvitiya [The Russian Arctic: Modern Development Paradigm]* (St. Petersburg: Nestor-Istoriya, 2014), 363. NEEDS PUBLISHER
5. Depending on the volume of technically recoverable resources, the Russian classification of deposits distinguishes between *unique* (over 300 million tons of oil or 500 billion m^3 of natural gas), *very large* (100–300 million tons of oil or 100–500 billion m^3 of natural gas), *large* (30–100 million tons of oil or 30–100

billion m^3 of natural gas), *medium* (10–30 million tons of oil or 10–30 billion m3 of natural gas), *small* (1–10 million tons of oil or 1–10 billion m^3 of natural gas), and *very small* (less than 1 million tons of oil or 1 billion m^3 of natural gas) deposits. http://gazovikneft.ru/articles/classification/.

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10. These numbers migrate from one publication to another for years. For one of the most recent references see: D. A. Vasil'ev, A. D. Kondratenko, "Primenenie tekhnologii GTL dlya povysheniya ekonomicheskoy tselesoobraznosti osvoeniya Shtokmanovskogo gazokondensatnogo mestorozhdeniya" [Applying GTL Technology for Improving the Economics of the Shtokman Gas-Condensate Deposit], in *World's Oil and Natural Gas Markets: Problems of Competition and Cooperation*, edited by S. V. Zhukov, 17.

11. A. I. Tatarkin, ed., *The Russian Arctic: Modern Development Paradigm*, 210.

12. A. I. Tatarkin, ed., *The Russian Arctic: Modern Development Paradigm*, 15, 288.

13. A. D. Lajpanova and M. Dzejgova, "Development of the Russian Arctic Shelf: Challenges and Prospects," 74.

14. *Osnovy gosudarstvennoj politiki Rissiiskoj Federacii v Arktike na period do 2020 goda i dal'nejshuyu perspektivu [On the Fundamentals of the State Policy of the Russian Federation in the Arctic up to 2020 and Beyond]*, endorsed by the president of the Russian Federation on 18 September 2008. http://www.scrf.gov.ru/documents/98.html.

15. A. I. Tatarkin, ed., *The Russian Arctic: Modern Development Paradigm*, 194.
16. According to other estimates, the level of production would not exceed 30 million tons of oil and 130 billion m^3 of gas: “Ekspert: k 2030 godu RF namerena dobyvat’ na shel’fe Arktiki do 30 mln. ton nefti i 130 mlrd. Kubometrov gaza” [Expert: By 2030, the Russian Federation Intends to Extract on the Arctic Shelf up to 30 Million Tons of Oil and 130 Billion Cubic Meters of Gas], Arctic Info: http://www.arctic-info.ru/News/Page/ekspert--k-2030-gody-rf-namerena-dobivat_-na-sel_fe-arktiki-do-30-mln--tonn-nefti-i-130-mlrd--kybometrov-gaza, posted 20 November 2012.
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28. See, inter alia: Elena Telegina, “Developing Natural Resources,” 487–89.
29. A. I. Tatarkin, ed., *The Russian Arctic: Modern Development Paradigm*, 210–11.

30. See, for instance: http://www.arctic-info.ru/News/Page/minenergo-predlagaet-pystit_-castnie-kompanii-na-sel_f-v-kacestve-podradcikov, posted 14 December 2012; http://www.arctic-info.ru/News/Page/-minprirodi-bol_se-ne-vistypaet-za-dopysk-castnih-kompanii-k-sel_fy, posted 09.07.2013. 9 July or 7 September????
31. Elena Telegina, "Developing Natural Resources," 488.
32. Vladislav Gordeev, *Sechin Projected Dramatic Change of Oil Prices After 2025*.
33. A. I. Tatarkin, ed., *The Russian Arctic: Modern Development Paradigm*, 231.
34. Elena Telegina, "Developing Natural Resources," 488.
35. For a recent review of ongoing projects see, inter alia: Vadim Ponomaryov, "Treasures of Permafrost."
36. A. I. Tatarkin, ed., *The Russian Arctic: Modern Development Paradigm*, 125.
37. V. I. Bogoyavlenskij, "Strategy for Developing Oil and Gas Resources under Current Conditions," 6–7.
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44. "Rossii pridetsya vplotnuyu zanyat'sya dobychey trudnoizvlekaemyh zapasov nefti [Russia will have to come to grips with the development of tight oil]," *Izvestiya*, 21 October 2014. http://izvestia.ru/news/578311.
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Commentary

James A. Slutz

INTRODUCTION

This commentary focuses on the potential for Arctic oil and gas production from the perspective of the United States. In his article, Pumphrey has provided a comprehensive picture of global energy and petroleum outlooks as well as an account of key questions around Arctic oil and gas development. These questions include:

- Will global energy systems require Arctic supply, and will the commodity price support anticipated higher development cost?
- Is public and community support sufficient to provide a social license to operate for companies interested in developing Arctic resources?

To address these issues and explore related topics from an American perspective, this commentary relies on a study recently completed by the National Petroleum Council (NPC) entitled Arctic Potential: Realizing the Promise of U.S. Arctic Oil and Gas Resources. The commentary begins by providing background on the study and key findings and then uses those findings not only to highlight areas of agreement with Pumphrey but also to identify areas where the potential for Arctic development may be enhanced with evolving technology.

While the commentary is based on the NPC Arctic Potential report, the content of the report is summarized to create space to respond to Pumphrey's paper for the 2015 North Pacific Arctic Conference on The Arctic in the Wider World organized by the East-West Center. Any future use of material from the NPC should be referenced directly from the Arctic Potential report (www.npc.org) according to the use provisions of the National Petroleum Council.

NATIONAL PETROLEUM COUNCIL STUDY—ARCTIC POTENTIAL

Before considering information based on the Arctic Potential report, it is important to understand the background of the study. The NPC is a federal advisory committee with the sole purpose of advising the US Secretary of Energy and the executive branch of government. The organization is self-funded and provides advice through studies requested by the secretary.

Secretary Moniz requested the study in October 2013 and posed the following questions and context:

- "What research should the Department of Energy pursue and what technology constraints must be addressed to ensure prudent development of Arctic oil and gas resources while advancing US energy and economic security and ensuring environmental stewardship?"
- The secretary also noted that the council's perspective would be helpful input to the US chairmanship of the Arctic Council, the Quadrennial Energy Review, and the implementation of the US National Strategy for the Arctic Region.

Within the context of this request, the NPC assembled a diverse study team. Study participants represented broad interests and expertise related to the topic. The Arctic study participants included 267 individuals affiliated with 105 organizations, with about 60 percent from non-oil-and-gas-production companies. Participants represented industry, government (federal, state, and local), universities, and Alaska Natives communities.

The NPC Arctic study has a strong focus on research and technology needed to address the secretary's request. In addition, to provide the context for the technical recommendations, the study also addresses economic and policy issues that are dependent on technology solutions. The study was approved by the council and presented to the secretary on 27 March 2015.

NPC ARCTIC POTENTIAL REPORT FINDINGS

- Arctic oil and gas resources are large and can contribute significantly to meeting future US and global energy needs.

- The Arctic environment poses some different challenges relative to other oil and gas production areas, but is generally well understood.
- The oil and gas industry has a long history of successful operations in Arctic conditions enabled by continuing technology and operational advances.
- Most of the US Arctic offshore conventional oil and gas potential can be developed using existing field-proven technology.
- The economic viability of US Arctic development is challenged by operating conditions and the need for updated regulations that reflect Arctic conditions.
- Realizing the promise of Arctic oil and gas requires securing public confidence.
- There have been substantial recent technology and regulatory advancements to reduce the potential for and consequences of a spill.

From these findings, the study team identified a total of thirty-two recommendations to further improve and enhance the prudent development of Arctic resources. These thirty-two recommendations can be categorized in terms of their primary focus as thirteen research, three regulatory, and sixteen leadership/policy related recommendations. The recommendations can be further grouped along the three themes of environmental stewardship, economic viability, and government leadership and policy coordination.

Several of the findings and the background discussions are directly related to further informing the discussion begun by Pumphrey's paper.

KEY AREAS OF PUMPHREY'S PAPER WHICH CAN BE FURTHER INFORMED BY THE NPC STUDY

Pumphrey makes a solid case that the global energy outlook has changed because of shale oil and gas development. His paper makes the further case that growing shale oil and natural gas, primarily from the United States, is the most significant factor in the dramatic decrease in global oil prices over the past year. These lower prices have caused a significant pullback in the planned investment in oil and gas development. Pumphrey also notes that high-risk, long-lead-time resources, such as those in the Arctic, face pressure on investment, at least in the near-term.

In addition, Pumphrey points out that Arctic resource development faces specific challenges because of the harsh environment. The Arctic environment creates added concerns regarding environmental stewardship and public acceptance of resource extraction. Pumphrey also makes the point that indigenous peoples may be concerned about or object to Arctic oil and gas development.

All the points raised by Pumphrey are valid concerns to be addressed in the consideration of US Arctic oil and gas development. The NPC report referenced previously addresses these issues directly. In particular, a more detailed review of findings 1, 4, and 7 will provide a fuller and more nuanced view of these issues raised by Pumphrey.

SELECT NPC FINDINGS ON ARCTIC RESOURCE POTENTIAL, PRUDENT DEVELOPMENT, AND ENVIRONMENTAL STEWARDSHIP

As noted previously, the NPC Arctic Potential report provides a comprehensive review of Arctic oil and natural gas development potential and challenges. The topics captured in the three noted findings (1, 4, and 7) on Arctic resource estimates, current production technology, and well control and spill response provide a strong response to the constraints raised in Pumphrey's paper.

Large Arctic Oil and Gas Potential

The United States Geological Survey completed an Arctic resource assessment in 2008. The Figures below summarize the estimated resource endowment. In Figure IV.13, the 426 billion barrels of undiscovered potential represents 25 percent of the global undiscovered resource potential, a significant component of undiscovered resources. Of this Arctic resource, 75 percent is estimated to be offshore.

In addition to the total resource, it is valuable to look at the projected geographical distribution as well as the difference between oil and natural gas. Figure IV.14 shows this breakdown between the Arctic countries. Since the primary objective of Arctic resource production will be oil, it is important to note that both Russia and the United States hold the largest potential for oil resources.

While confirming the importance of current oil production from

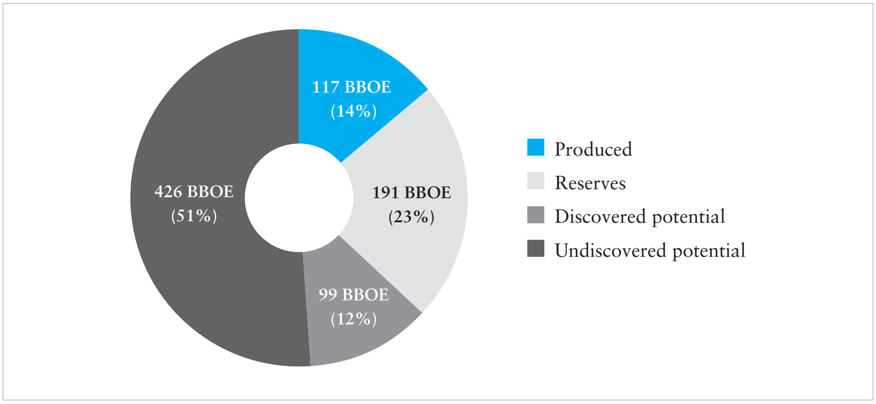


Figure IV.13 *Global Arctic Conventional Endowment*

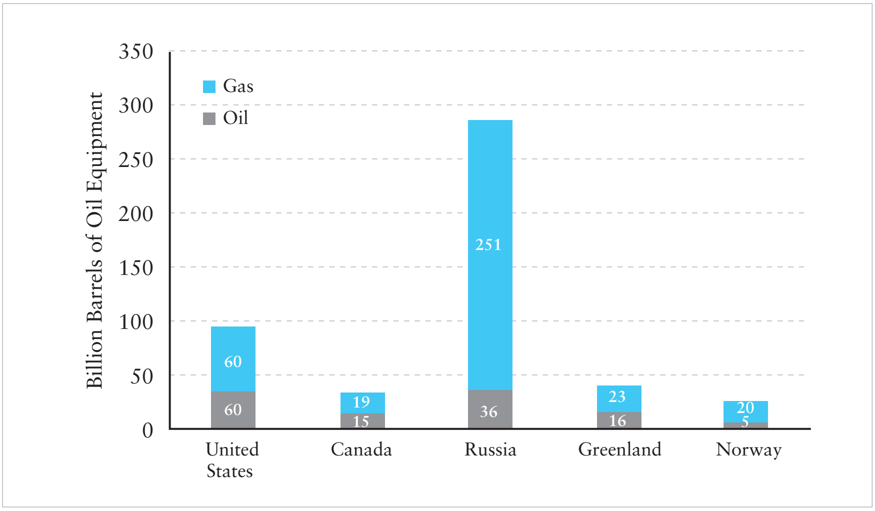


Figure IV.14 *Global Arctic Conventional Oil and Gas Resource Endowment by Country*

shale, the Arctic Potential report notes that the 2014 Energy Information Administration (EIA) projections estimate that US oil production from shale is anticipated in 2040 to decline by a million barrels per day from 2014 production levels. Because of the nonrenewable nature of oil and the natural decline of a well's production, new resources must continually be developed to replace production from older wells.

Most US Arctic Offshore Resources are Developable Today

A common misperception is that there is one Arctic. In reality, the Arctic offshore environment has great variability depending on many factors. For purposes of oil and gas technology, the Arctic can be divided into five environments based on water depth and ice environment. Figure IV.15 illustrates these five conditions, noted in the first column.

These offshore environments have different technology requirements for oil and gas development. These requirements include the type of permanent oil and gas facility that is needed and whether the water depth can sustain a bottom-founded structure or a floating structure is required. The second key constraint is the ice conditions and the amount of time the surface is ice-free. Note that in the graphic above, technology responses exist for the

Increasing complexity to explore & develop

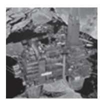
Physical ice environment and water depth		Technology to explore & develop
Discription	**Examples**	
Typically ice free, any water depth • Minor first year intrusions, icebergs possible	• South Barents sea • Newfoundland	**Exploration & development proven** (Various drilling rigs, floating solutions, GBS, subsea tieback) Snohvit Subsea  Hibernia GBS 
Any ice conditions, near shore & shallow water • ~< 15 m water	• Globally, near shore (including US Beaufort and Chukchi seas)	**Exploration & Development proven** (Ice & gravel islands, concrete & steel structures, extended reach drilling from onshore) Spray ice island  Northstar 
Open water > ~2 months, any water depth • Mainly first year ice, potential for combination of multi-year ice, icebergs and ice islands • Water depth determines development concept (greater or less than ~100 m is key)	• Sea of Okhotsk • Pechora sea • Labrador sea • US Chukchi & Beaufort seas • South Kara sea	**Exploration proven; development proven mainly in ~< 100 m water** Ice management required ~< 100 m development by GBS ~> 100 m development by floating drilling & subsea tieback Canmar drillship  Sakhalin-2 GBS 
Open water < ~2 months, any water depth • Likely to encounter multi-year ice and/or icebergs, and in some locations ice islands • Water drpth determines development concept (greater or less than ~100 m is key)	• Deepwater Beaufort sea • Deepwater Northern Russian Arctic seas	**Exploration & development possible with technology improvements** Increased ice management capability and possible new technology
Limited to no open water • Frequent multi-year ice with embedded icebergs, and ice island	• North east Greenland • Deepwater Northern Russian Arctic seas	**Technology extensions or new technology required** Floating, robust ice managed solutions GBS/Subsea technology extensions or new technologies Difficult to mobilize equipment without open water season

Figure IV.15 Arctic Environments and Oil and Gas Development Technology first three conditions because these have been used in the United States or in other Arctic conditions around the world, and the technology challenges have been addressed effectively. The US Arctic offshore prospective production areas are noted in red and exist in operating environments where existing technology can be used. Therefore, technology constraints do not limit US offshore Arctic development.

Well-control Technology Improvements

Prudent development of offshore US Arctic resources is contingent on being able to prevent major oil spills and respond effectively should any spills occur. Over the past four decades, the oil industry has made significant advances in being able to prevent, contain, and mitigate impacts of spills in Arctic environments. Even so, concerns remain regarding industry's capability to prevent and to promptly deal with spills in Arctic waters, especially in the presence of ice. Addressing these concerns is central to the acceptance of extended-season drilling operations, which are key to conducting economic exploration and development in areas where open-water seasons are severely limited.

Effective environmental stewardship consists of both prevention and response capability. Industry's primary focus is on spill prevention. However, the risk of a spill can never be eliminated completely, so effective oil-spill response capability is also critical. The "bow tie" diagram in Figure IV.16 illustrates the spectrum of measures industry employs to protect the environment from spills due to loss-of-well-control incidents. On the left side of the bow tie are prevention measures aimed at reducing the risk of an incident in the first place. Prevention is accomplished through a set of primary and secondary barriers.

At the center of the bow tie is a loss-of-well-control incident, which means that the primary and secondary barriers have been breached, and there is a loss of containment of wellbore fluids. The right side addresses limiting the size of a spill and responding to a spill once containment is lost. Flow-stoppage measures on the right side are employed to stop the outflow of a well to the environment through the use of shut-in devices such as a capping stack or a pre-installed shut-in device at the seafloor.

On the right side of the bow tie are the various spill response measures that can be used to remove spilled oil from the environment and minimize environmental damage. These include tracking spilled oil, mechanical

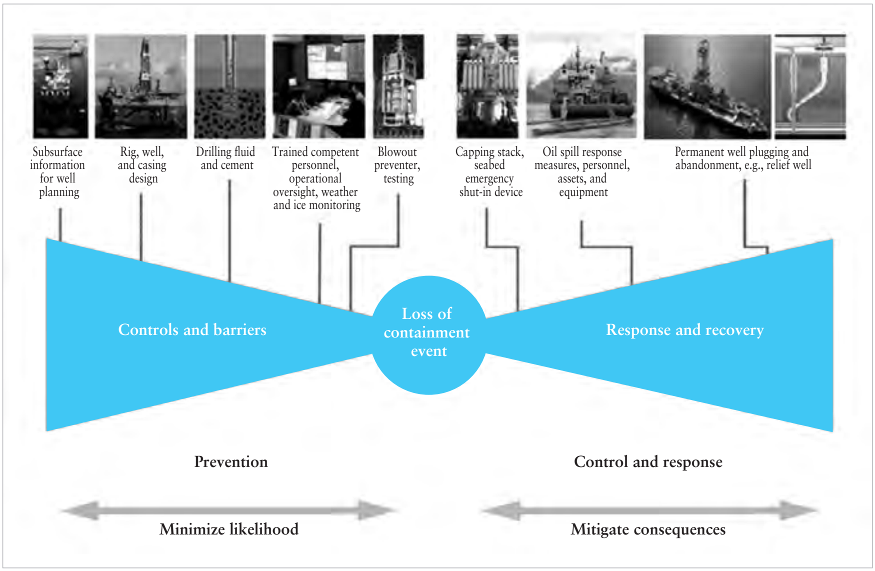


Figure IV.16 *Well Control, Containment, and Spill Clean-up Technologies*

recovery using booms and skimmers, in-situ burning of the oil, and the use of dispersants. The potential for encountering sea ice, cold temperatures, and potentially limited shore infrastructure are key features that differentiate Arctic spill response from similar operations in other areas. While challenging in many respects, research has also shown that cold temperatures and ice can slow the spreading of spilled oil.

NPC Arctic Potential Report Recommendations Overview

Although the technology exists today to develop oil and gas in the US Arctic, an important distinction is that not all technology has been validated for use in the United States and incorporated into regulations. New technology has the potential to extend the drilling season or otherwise improve the economic prospects of Arctic development. In addition, research and technology advancement will continue to improve safety, reduce environmental impact, and increase cost performance. The study recommendations that address policy and regulatory issues are in areas where changes could enable the application of best technology and practices. Following is a summary of a few of the key recommendations. The comprehensive set of recommendations is available in the full NPC

Arctic Potential report.

Environmental Stewardship

The study recognized that maintaining a social license to operate was a critical enabler of Arctic development and that environmental stewardship is essential in that process. The recommendations focus on enhancing the sharing of information and research between various entities. These include:

- industry and regulators should work together to perform the analysis, investigations, and any necessary demonstrations to validate technologies for improved well control;
- government agencies should participate in ongoing and future industry-collaborative research programs for oil-spill response in ice, such as the Arctic Response Technology Joint Industry Program that has been underway since 2012;
- regulators should continue to evaluate oil-spill-response technologies in Arctic conditions, and all spill-response technologies should be pre-approved to enable selection of the appropriate response technology to achieve the greatest reduction in adverse environmental impacts;
- long-term population estimates and understanding of the interactions of key species with oil and gas activities should be improved, to improve efficiency of exploration and environmental stewardship; and
- collaboration and coordination of ecological and human-environment research should be improved.

Economic Viability

Extending the drilling season would enable the drilling of at least one well in the same drilling season, greatly reducing costs. To accomplish this, technologies that are at least as protective as a same-season relief well must be validated and approved. Regarding Arctic leases, the United States development-based leasing system requires updating to an exploration-based system, similar to other Arctic nations. Recommendations to improve economic viability include:

- industry, government, and regulators should perform the analysis, investigations, and necessary demonstrations to validate technologies/ capabilities to safely extend the drilling season;
- the Department of Energy and the Department of the Interior should assess the timelines to proceed with an offshore exploration and development program, compared with current US lease durations and practices in other jurisdictions; and
- policies, regulations, and implementation practice should encourage innovation and enable use of technology advances.

Figures IV.17 and IV.18 illustrate the drilling season and Arctic-lease challenges. An Arctic well requires approximately eighty days to drill. Under current practices, therefore, two drilling seasons may be required to drill a single well. Regarding lease terms, the development-based leasing system of the United States is well suited for Gulf of Mexico development where year-round operations are feasible. However, in an environment with only two to three months of drilling time per year, economic and physical constraints create a difficult challenge in the Arctic for this to be an effective system.

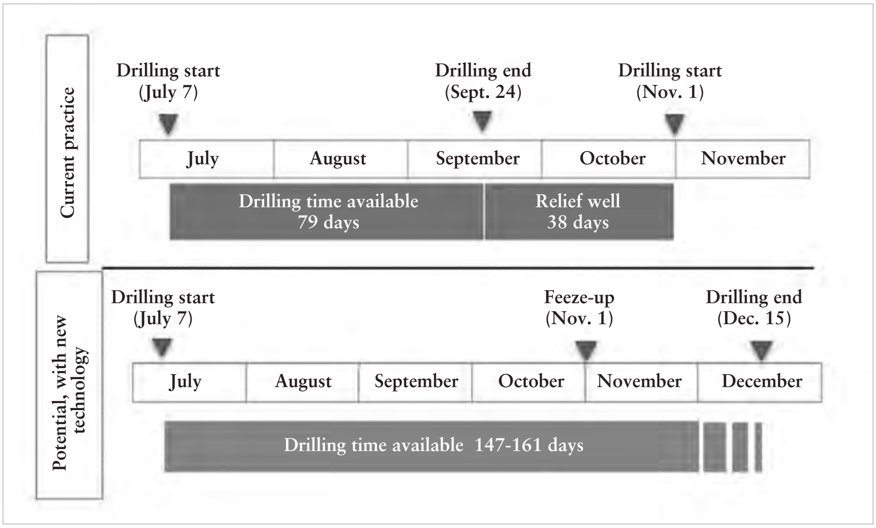


Figure IV.17 *Drilling Season Length*

Country	License/lease system	Typical well count to retain license/lease	License/lease duration
Canada	Exploration based	1-2	9 years
Greenland	Exploration based	1-2	Up to 16 years
Norway	Exploration based	1-2	Up to 30 years
Russia	Exploration based	1-2	10 years
USA	Development based	6-7	10 years

Figure IV.18 Lease Length

Government Leadership and Policy Coordination

In response to the secretary's request for the NPC to inform the US chairmanship of the Arctic Council, following are selected recommendations:

Domestic leadership and policy coordination

- the Arctic Executive Steering Committee should reaffirm the US commitment to prudent Arctic oil and gas development, assess alignment across federal agencies, and clarify the process by which it will collaborate with Alaskans;
- the Arctic Executive Steering Committee, as part of its mandated gap analysis, should request regulators to compile a comprehensive and integrated inventory of regulatory requirements and assess the interagency working group's experience for lessons learned and improvement opportunities; and
- the Department of Energy should designate a senior advisor to support its representative on the Arctic Executive Steering Committee and be a focal point for Arctic policy.

Arctic Council

- as Arctic Council members implement the two international agreements on search and rescue (2011) and on oil-pollution preparedness and response (2013), the US government should engage with the energy industry on response exercises and
- the US government should strengthen the Arctic Economic Council's interaction and engagement with the Arctic Council.

CONCLUSIONS

The world's energy supply is composed of a portfolio of sources of energy, and oil and natural gas are projected to continue to be part of that portfolio for many decades to come. When analyzing future supplies of oil and natural gas, the various sources of supply comprise many components including: conventional reservoirs, shale formations, enhanced recovery, onshore, offshore, deep-water, Arctic, and others. The largest component geographically of undiscovered oil and natural gas is the Arctic with 25 percent of the estimated undiscovered global resource. From a security-of-energy-supply perspective, a portfolio of oil and natural gas supply from different sources, including Arctic, will be important to meet future energy demand.

While there is a history of Arctic oil and natural gas development, including on-shore production in the United States, developing offshore US resources requires a long lead time. Once sufficient petroleum reserves are discovered, production of those reserves would not occur for about twenty years, because of the infrastructure and development activities required to bring the oil and natural gas to market. Delaying the start of exploration would push those potential energy supplies further into the future. While shale oil and natural gas development has dramatically increased US production in recent years, EIA projects that production will plateau over the next twenty years and that a decline of one million barrels of oil a day will occur in 2040 relative to 2014 production levels.

Environmental and social concerns remain an important component of maintaining a social license to operate. Securing public confidence requires that Arctic resources be extracted safely while protecting the environment and maintaining Arctic indigenous lifestyles. Many Arctic peoples support development and see an opportunity for resource development to be mutually beneficial, allowing their communities to maintain a traditional lifestyle while also realizing the benefits of twenty-first century society. One key to harmonizing development with indigenous communities is to involve the community leaders in the decisions for development.

The technology exists to allow safe and prudent development of oil and natural gas in the Arctic in the United States. Further advancements in technology will lower potential risks, increase the benefits to Arctic communities and improve energy supply diversity for the world as a whole.

Commentary

Keun-Wook Paik

The development of Arctic resources has long been seen as a possibility that likely to be realized in the coming decades. The big question is not whether but when it will happen. The new technology development is fundamentally changing the structure of conventional and nonconventional oil and gas supply on a global scale. First, the shale revolution in the United States is no longer a momentary phenomenon but has become a game changer of global energy business. The impact of the US shale revolution on global oil supply is not small as the US became one of the top three ten thousand barrels/day (mb/d) crude oil producers in the world. Considering that the US has relied heavily on imported crude oil until the middle of the first decade of this century, the change affects the global energy structure profoundly.

Another big potential change lies in the prospect of large scale of export of gas by pipeline pipeline from Russia to Asia, in particular to China, if the unfulfilled potential becomes a reality without too much delay. Russia's pivot to Asia is gaining momentum and the supply of oil and gas from Russia to Asia, in particular to China, on a large scale is no longer a matter of whether but when. During 2013–14, Sino-Russian oil and gas cooperation achieved major breakthroughs for both crude oil and natural gas supply. In 2013, the combined crude oil supply deals recorded as much as USD 355 billion, including USD 270 billion for fifteen million tons/year (mt/y) crude supply for twenty years between Rosneft and China National Petroleum Company (CNPC), and USD 80 billion for 10 mt/y crude supply for ten years between Rosneft and China Petroleum and Chemical Corporation (SINOPEC). In May 2014, these crude oil supply deals were dwarfed by the USD 400 billion Power of Siberia (POS) pipeline gas supply deal (POS I: 38 billion [10^9] normal cubic meters per year [bcm/y] supply for thirty years) between Gazprom and CNPC. Six months later, a memoranda of understanding (MOU) for a 30 bcm/y Altai pipeline gas supply (now POS II) to China was signed. The combination of crude-oil and pipeline gas supply deals will amount to around USD 1.0 trillion; the sheer scale is big enough to deliver a real impact toward competing with other oil and liquefied natural gas (LNG) supplies for China.

If a third game changer for the global energy market exists, the potential lies in the massive gas reserves discovered in offshore areas of Mozambique and Tanzania. The scale of proven reserves could reach two hundred fifty trillion cubic feet (tcf). If the combined capacity of LNG reaches ten trains or fifty million tons/year (mt/y), it ensures the transformation of East Africa's LNG production base into a reliable global LNG supply hub in the coming decade. The above-mentioned factors were inconceivable until the early 2000s; advanced technology development made all these changes possible. Of course, the above three game changers will be severely affected by the current low oil price, but it is clear that the current low oil price is not sustainable indefinitely. Likewise, it will be only a matter of time until the focus of the Arctic area's oil and gas development moves from the huge potential to the era of commercialization.

In this context, it is worth highlighting Pumphrey's point regarding "Russia's energy relationship with China." The paper states that "Russia's effort to build a stronger relationship with China has been accelerated by the US and European pressure . . . Opening stronger energy ties with China, the fastest growing energy consumer, is important to maintaining and expanding Russia's energy exports. The confrontation with the West over Ukraine has reinforced this policy. After many years of negotiations and numerous agreements, Russia and China finally completed negotiations to build a natural gas pipeline into eastern China in 2014. This was followed by an additional agreement on a natural gas pipeline into western China. Chinese energy companies such as CNPC have been granted greater access for investment in the Russian energy sector."

To understand the importance of the strengthened Sino-Russian gas cooperation,[1] this commentary will elaborate on the role of massive pipeline gas deals. What drove Russia to push its "Pivot to Asia" policy so aggressively and hurriedly? Russia was quite naïve with regard to the US shale revolution factor but realized this revolution became the driving force of the US "Pivot to Asia" policy that envisages a large scale export of US LNG to Asia. Basically Asia becomes the battleground for Russian and US "Pivot to Asia" policies. In fact, the total pipeline gas supply volume of 68 bcm/y by Power of Siberia I and II (formerly the Altai pipeline, see Figure IV-19) can wipe out 48 mt/y of LNG market from China, and it will deliver a big impact toward LNG price negotiation in the coming decades as only LNG supplies with competitive prices will penetrate the lucrative Asian LNG market.

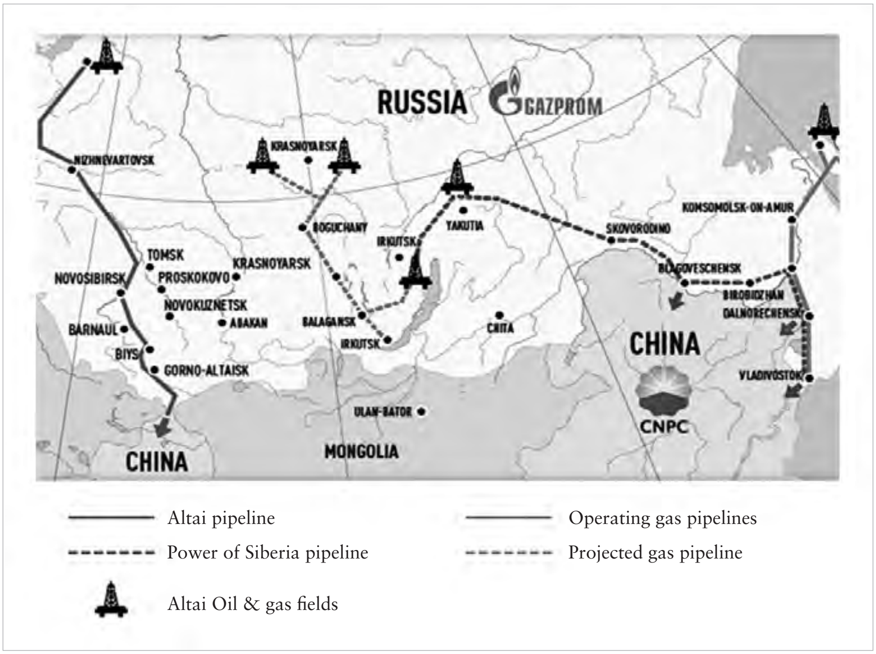


Figure IV.19 *Russia's Gas Pipelines*

If Russia's pipeline gas fails to enter into China's huge gas market in time, Russia will have to struggle to compete against the LNG supply options from other parts of the world, including Qatar, Australia, North America, and East Africa. Already Gazprom has indicated the POS I supply could be delayed one to four years and the delay could open the door for LNG supply to the protected Bohai gas market. Strictly speaking, out of the 38 bcm/y, only the 20 bcm/y pipeline market in Heilongjiang, Jilin, and Liaoning provinces will be safe. The remaining 18 bcm/y pipeline gas market in Hebei province (where Beijing and Tianjin are located) and Shandong provinces is quite vulnerable to LNG supply with competitive prices. As Novatek's management argues, the price will be competitive enough, and China's number one national oil company, China National Petroleum Corporation's aggressive entry into Russia's Yamal LNG as the equity investor and LNG importer can be justified as a wise initiative to protect CNPC's Bohai gas market to a certain extent. Initially, the logic of Yamal LNG import was that diversification of LNG supply from Russia is good for China's energy security. It is not an exaggeration to say that, like Japan, China is always thinking of diversifying its oil and gas supply sources. It is quite natural for Beijing to show its serious interest in LNG supply via the northern route.

EXPLORATION OF NORTHERN SEA ROUTE (NSR) OPTION BY ASIAN CONSUMERS

In September 1989, a Soviet vessel carried cargo from Hamburg to Osaka in twenty-two days via the Northern Sea Route (NSR). Previously, such sailings have taken less than twenty days in summer. By the Suez Canal, voyages from continental Europe to the same destination would normally take between thirty and thirty-three days. In 2010, a long-term-cooperation agreement regarding transportation of hydrocarbons was signed between CNPC and the Russian company Sovcomflot, which is Russia's largest shipping company and one of the global leaders in the maritime transportation of hydrocarbons as well as the servicing and support of offshore exploration and oil and gas production.

The push toward lengthening the Arctic sailing season is exemplified by the first successful winter passage through the NSR in November 2012,[2] when the *Ob River*, a large Russian tanker, carried a cargo of 134,000 m^3 of LNG from Hammerfest in northern Norway to Tobata in southwestern Japan. Kyushu Electric Power Company purchased LNG from Norway's Hammerfest Snøhvit LNG project shipped via the Northern Sea Route. On 5 December 2012, Gazprom announced that the firm successfully completed the world's first LNG supply via the NSR, using the *Ob River* LNG carrier.

While LNG tanker rates vary from company to company and season-to-season, short-term charters were averaging USD 90,000+ a day, with long-term charters around USD 80,000 a day, according to an August 2013 presentation by global consultants PFC Energy in Anchorage. Short-term rates spiked in 2012 at USD 150,000 a day, with long-term charters running USD 120,000. At those prices, cutting ten days off a trip to Tobata could save USD 1 million.

Tanker time was not the only savings, according to the agency that runs Russia's nuclear icebreakers on the NSR. The Ob River also saved about USD 80,000 in tariffs. The agency, Rosatomflot, put the ship's icebreaker fees for the trip at USD 332,000 versus USD 412,000 that would have been charged for passing through the Suez Canal. Compared with Snøhvit, which has been producing LNG since 2007 on Norway's northwest coast, Yamal is about 1,150 miles closer to Japan by the NSR.

In late August 2013, another load left Snøhvit for Tokyo Electric (TEPCO) on a tanker called the *Arctic Aurora*.[3] It was due at the company's Futtsu LNG terminal, near Tokyo, in mid-October and arrived on schedule. Statoil has chartered an LNG tanker of its own to move LNG over the NSR. The tanker, the Clean World, was to start service for Statoil in the fall.

In early July 2014, a major announcement by Mitsui O. S. K. Lines, Ltd., and China Shipping Development Company (CSD) offered new details of how LNG will get from one of the remotest locations on earth, the USD 27 billion Yamal LNG facility being developed in Western Siberia, to urban areas in China and Japan.[4] CSD said its joint venture with Mitsui O. S. K. would invest USD 932 million in three LNG carriers equipped as icebreakers to be built by Daewoo Shipbuilding and Marine Engineering Company (DSME) of South Korea. Service is set to begin as soon as 2018. The ships ordered by Mitsui O. S. K. and CSD are part of an expected fleet of sixteen ice-breaker-equipped LNG carriers for the Yamal LNG project.

It is worth noting that in 2010, for the first time in recorded history, four commercial vessels sailed from northwestern Europe to Northeast Asia via the NSR, which passes through the Arctic Ocean above Eurasia. That number jumped to thirty-four in 2011 and to forty-six in 2012. The figure reached seventy-one in 2013, but collapsed to thirty-one in 2014. The expansion momentum was temporarily lost.

YAMAL LNG TO ASIA

Novatek,[5] Russia's largest independent natural gas producer, is in negotiations with Chinese banks to obtain USD 10 billion in loans to finance the USD 27 billion Yamal LNG project (see Figure IV.20), in Western Siberia, which could double Russia's share of the global LNG market. France's Total and China's CNPC are partners in the project. Yamal's fifteen-year supply deal with 3 mt/y volume with CNPC[6] will help expand NSR LNG trading.

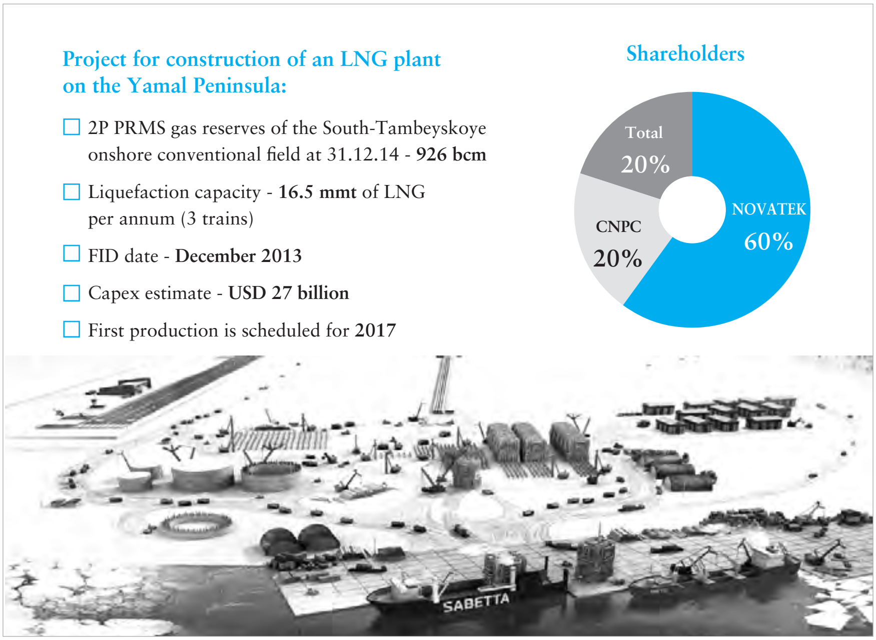


Figure IV.20 *Yamal LNG Project*

CHINA'S FOCUS ON NSR SHIPPING

The NSR is already navigable for four to five months during the summer (see Figure IV.21). In September 2010, a cargo ship from the Danish shipping company Nordic Bulk Carriers completed the first-ever commercial passage through the Northern Sea Route to China. The cargo was 41,000 tons of iron ore and, compared with passage through the Suez Canal, sailing time was just one third. The shipping company saved USD 180,000 in fuel costs and a corresponding amount of carbon dioxide (CO_2) emissions. In 2012, the firm completed forty-six voyages, accounting for 75 percent of all voyages through the NSR. The same year, the polar research icebreaker Xuelong became the first Chinese vessel to successfully navigate the NSR into the Barents Sea, returning to the Bering Strait via the North Pole.

In 2013, when the 19,000-ton Chinese container ship *Yong Sheng* arrived in Rotterdam, a new chapter in the history of an increasingly ice-free Arctic was written. It was the first time a large container vessel sailed from Asia to Europe by the NSR. *Yong Sheng's* journey from Dalian in China to Rotterdam Netherlands took only thirty-five days. *Yong Sheng*

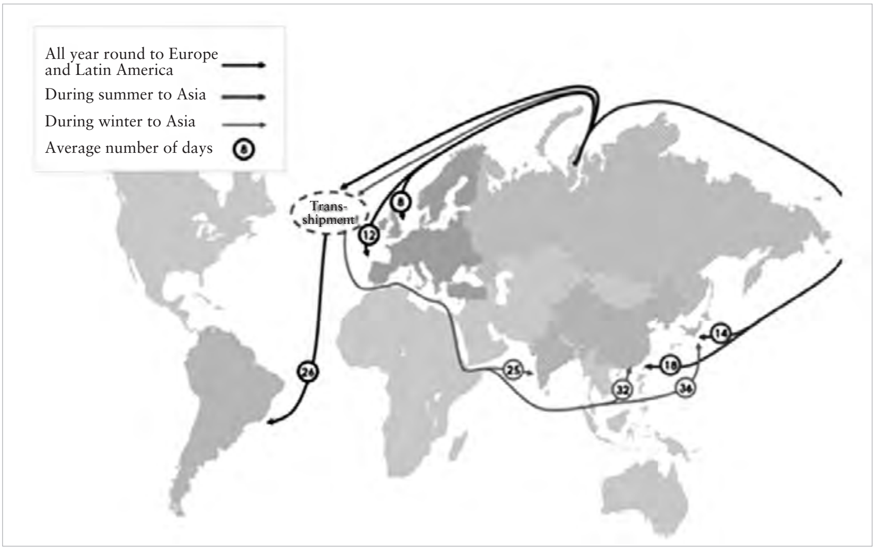


Figure IV.21 *LNG Transportation Routes from the Yamal Peninsula*

belongs to the state-owned China Shipping Company (COSCO), which has the world's sixth largest fleet of container ships.

In fact, research published in 2014 indicates that the NSR as an alternate to the Suez Canal offers 50 percent reductions in sailing distance between ports in Northern Europe and Northeast Asia. The cost-efficiency potential of the NSR over the Suez Canal is 42 percent, and an LNG carrier sailing between Norway and Japan offers a saving of USD 4.7 million for a round-trip voyage.

The CO_2 emissions from an LNG vessel sailing between Northern Europe and Northeast Asia via the NSR are about fifty-two percent less than the same vessel going through the longer passage of Suez Canal. The CO_2 emissions from an LNG carrier navigating between Northern Europe and Northeast Asia via the Suez Canal are 18,585 tons. Via the NSR, emissions are 8,854 tons per round-trip voyage.

It is worth noting that the vessel is assumed to use boil off gas as a bunker fuel on the ballast leg, but in reality the dual-fuel diesel-electric (DFDE) LNG vessels burn heavy fuel oil when they do not have cargo on board, and this may alter the value calculated with regard to CO_2 emissions.

In September 2011, when then Premier Vladimir Putin of Russia touted the NSR as an emerging rival to the Suez and Panama Canals, Chinese analysts shared Putin's optimism, calculating that China could save a staggering USD 60–120 billion per year solely by diverting trade through the NSR. China's Twelfth Five-Year Plan (2011–15) reflected China's ambition, announcing three new Arctic expeditions to be conducted before 2015. Moreover, China intended to launch the first of a series of new icebreakers to join *Xuelong*, thus enabling the Chinese Arctic and Antarctic Administration (CAA) to conduct more frequent polar exploration and research missions. When the 1.25 billion RMB (USD 198 million), eight-thousand-ton vessels set sail, China will possess icebreakers that are larger than and qualitatively superior to those of the U.S. and Canada.

STOCKHOLM INTERNATIONAL PEACE RESEARCH INSTITUTE (SIPRI) FINDING ON CHINA'S ARCTIC INTEREST[7]

In April 2013, the Stockholm International Peace Research Institute's (SIPRI) publication on "The North East Asian States' Interests in the Arctic and Possible Cooperation with the Kingdom of Denmark" pointed out that one event that sparked China's geopolitical interest in the Arctic was Russia's decision in 2007 to deploy a nuclear submarine to the North Pole to plant a Russian flag on the seabed. It added that the Antarctic is the main focus of China's polar research, and this emphasis is expected to continue. Only about one-fifth of the government's polar resources are devoted to Arctic expeditions. China has undertaken twenty-eight expeditions to the Antarctic but only five to the Arctic.

China's polar activities are funded by several ministries and agencies administered by the State Council, China's high-level governmental body to which the Communist Party entrusts day-to-day administration of the country. For example, the decision in 2011 to build a new icebreaker was made by the State Council. The Ministry of Transport (MOT) in 2012 initiated a preliminary feasibility study into the Northern Sea Route. The MOT will presumably take a leading role in facilitating Chinese commercial shipping in the Arctic, including a pilot voyage planned for the summer of 2013.

The SIPRI study highlighted that the most significant Arctic-related shipping development in China is the leasing of North Korea's Rajin Port by Hunchun Chuangli Haiyun Logistics Company in China's northeastern Jilin province. The company is private but the lease was agreed "in cooperation with six Chinese ministries and the Jilin provincial government." In 2008, a lease was signed for pier 1 for ten years. This agreement granted China an access to Donghae/Sea of Japan for the first time since 1938. Although the Arctic was not mentioned in the media reports, Chinese scholars presumably view Rajin as a potential Arctic hub. According to Chinese analysts, "the opening of Arctic shipping routes will significantly add advantages to the Tumen River area." In late 2011, the lease was extended for another twenty years. A year later, Hunchun Chuangli's parent company, Dalian Chuangli Group, leased piers 4, 5, and 6 of Rajin Port for fifty years.

The SIPRI study confirmed Northeast Asian States' keen interest in diversifying the LNG supply sources and routes. Once the Yamal LNG project becomes operational, the LNG supply via the NSR will help expanding the NSR trading volume significantly. At the moment, only 3 mt/y out of the 16.5 mt/y (3 trains) is being allocated to CNPC. It is not clear how much will be allocated to China and Asian gas market ultimately.

As shown in Table IV.3, China aims at importing more pipeline gas than LNG. Only competitively priced LNG can penetrate into China's already congested LNG market.

One way to reduce the Yamal LNG price effectively is based on lending at low interest from Beijing. In this context, Beijing's financing of Novatek LNG project will be critical and the key question is not whether but how

Table IV.3 Outlook for China's Gas Market

	2015		2020		2030	
	C	O	C	O	C	O
Conventional	132.0	138.5	170.0	185.0	210.0	230.0
Unconventional	14.9	18.8	31.6	59.7	57.3	116.0
-SG	5.0	6.5	10.0	30.0	20.0	60.0
-CBM	7.9	9.3	11.6	14.7	27.3	26.0
-CTG	2.0	3.0	10.0	15.0	30.0	30.0
Imported LNG	35.0	40.0	60.0	70.0	70.0	80.0
Imported pipe gas	40.0	44.0	75.0	80.0	120.0	130.0
Total	224.9	241.3	336.6	394.7	457.3	556.0

Note: C means conservative projection, and O means optimistic projection. SG means shale gas. CTG means coal to gas

Source: CNPC, 2015.

large scale Chinese financing will be. On top of CNPC's 20 percent equity stake in the project, Novatek has provided a 9.9 percent equity stake to China's Silk Road's Fund by concluding the framework agreement on acquisition of stake in Yamal LNG in Beijing. The deal first discussed in August 2015 and worth an estimated USD 1.4 billion was concluded on 3 September 2015 as a part of a visit by President Putin to Beijing to mark seventy years since the end of World War II in Asia.[8] Based on almost 30 percent equity stake in the project, Beijing looks very likely to offer large-scale lending for Yamal LNG with a special interest rate. Once the loans are made, time will tell whether the financing will be as important as the USD 6 billion lending from Beijing to Rosneft in late 2005. Yamal LNG supply to China via the NSR route will make a solid contribution to the strengthening of Sino-Russian oil and gas cooperation in the coming decades.

Notes

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PART V

ARCTIC STEWARDSHIP: PROTECTING THE ARCTIC OCEAN

5. Arctic Stewardship: Protecting the Arctic Ocean

Suzanne Lalonde[1]

As Koivurova has emphasized, it was shared concerns over threats to the Arctic environment that jump-started Arctic-wide cooperation.[2] Meeting in Finland in 1991, the eight Arctic states adopted the Rovaniemi Declaration[3] and committed themselves to a joint plan of action, the Arctic Environmental Protection Strategy (AEPS).[4] The AEPS contained ambitious objectives, chief among them "to identify, reduce, and, as a final goal, eliminate pollution."[5]

Marine protected areas (MPAs) are increasingly recognized as a valuable complement to traditional management strategies to protect the biological diversity and integrity of the world's oceans and seas, including in the Arctic. The International Union for Conservation of Nature and Natural Resources (IUCN) defines a protected area as a "clearly defined geographical space, recognized, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values."[6] To help clarify which marine sites could qualify as protected areas, IUCN adopted in 1999 a specific definition for MPAs:

> *Any area of intertidal or subtidal terrain, together with its overlying water and associated flora, fauna, historical and cultural features, which has been reserved by law or other effective means to protect part or all of the enclosed environment.*[7]

The term MPA is generic and is therefore used to refer to all marine sites that meet the general protected-area definition, regardless of purpose, design, management approach, or title (marine reserve, sanctuary, natural monument, marine park, etc.). Given the prevalence of the term MPA and the different meanings and connotations attached to it, various typologies of marine management areas have been developed to try and dispel confusion. The typology developed by IUCN is now internationally recognized and facilitates a global system for recording and classifying protected areas and the wide variety of aims they can embody.[8]

Both the IUCN and the United Nations Convention on Biological Diversity's (CBD) Subsidiary Body on Scientific, Technical, and Technological Advice (SBSTTA) recommend that a range of types of management areas be considered when designing a protected areas system: no-take areas, community-managed areas, fishery management areas, seasonal and temporary management areas, whale sanctuaries, etc.[9] "Multiple-use MPA zoning [. . .] provides a way to accommodate multiple users, balancing the trade-offs between sustainable use and conservation objectives for effective management."[10] The two lead organizations (IUCN/CBD) also emphasize that protected areas should not be seen as isolated entities but as part of the broader ecosystem approach to conservation, implemented across an entire seascape.

The Arctic Council's recently updated Arctic Marine Strategic Plan (AMSP) 2015–25[11] is founded on such a holistic approach, which is described as the key to achieving the four goals of the plan: to improve knowledge of the Arctic marine environment, to conserve and protect ecosystem function and marine biodiversity, to promote safe and sustainable use of the marine environment, and to enhance the economic, social and cultural well-being of Arctic inhabitants.[12] Developed by the council's Working Group on the Protection of the Arctic Marine Environment (PAME), the plan emphasizes that, for an integrated ecosystem-based management approach to be effective, conservation goals and sustainable-use activities must be balanced and coordinated.[13] Due to the flexibility in their design, MPAs can promote ocean stewardship practices that are at once representative, comprehensive, and balanced and for this reason, have become an essential element in the ecosystem management toolbox.[14]

INTERNATIONAL AGREEMENTS/ARRANGEMENTS

A number of global instruments exist that encourage and even require state parties to designate and manage vulnerable marine areas under their jurisdiction as protected areas. While none of these agreements specifically target the Arctic region, they can and are relied upon to help protect polar marine environments. It is important to consider the rate of participation of the eight Arctic states to these various international legal instruments and the extent to which the mechanisms created have been operationalized. As a recent study emphasizes, this assessment will reveal the presence or absence of "convergent and mutual expectations on the accepted international principles, norms, rules and procedures of the international regimes"[15] among the circumpolar states.

Among the Arctic eight, only the United States is a party to the Convention on Nature Protection and Wildlife Preservation in the Western Hemisphere,[16] which invites governments to explore the possibility of establishing national parks, national reserves, nature monuments, and strict wilderness reserves "in their territories."[17] To date, no Arctic MPA appears to have been established off the coast of Alaska on the basis of this convention. A more significant instrument from the same period is the International Convention for the Regulation of Whaling (ICRW),[18] adopted with a view to ensuring "proper and effective conservation and development of whale stocks"[19] through measures including the designation of whale sanctuaries. While all the Arctic states are parties to the ICRW save for Canada,[20] no whale sanctuaries have been designated in Arctic waters.

All of the eight Arctic countries are party to the Ramsar Convention,[21] which seeks to preserve wetland habitats of particular importance to migratory waterbirds through the designation of dedicated sites.[22] The convention uses a broad definition of "wetlands" that includes estuaries, deltas, tidal flats, and near-shore marine areas. There are over 2,000 Ramsar sites worldwide; summary information for each site can be accessed through an interactive map on the "Ramsar sites" webpage.[23] Unfortunately, the "Ramsar Sites Information Service database" does not include the Arctic in the "region/country" filter.[24] Thus, information about the number of Arctic Ramsar coastal or marine sites designated by the eight Arctic Council member states (Canada, the Kingdom of Denmark [including Greenland and the Faroe Islands], Finland, Iceland, Norway, Russia, Sweden, and the United States—the "A8") had to be gleaned from the interactive world map using the Arctic Monitoring and Assessment Programme's (AMAP) "Arctic Boundary"[25] as a rough guide: Out of a total of thirty-seven Ramsar sites, Canada has only three coastal or marine sites within the AMAP Arctic boundary;[26] Denmark (including Greenland and the Faroe Islands), seven out of forty-three sites;[27] Finland, none out of forty-nine sites; Iceland, one out of six sites;[28] Norway (including Svalbard), thirteen out of sixty-three sites;[29] Russia, three out of thirty-five sites; [30] Sweden, none out of sixty-six sites; and the United States, one out of thirty-seven sites.[31] In 2008, the authors of a United Nations Environment Programme (UNEP) report on "National and Regional Networks of Marine Protected Areas" commented that efforts were underway to increase the representation of marine habitats in the network of Ramsar sites.[32] Clearly those efforts must be intensified in regards to coastal and marine sites in the Arctic.

The World Heritage Convention,[33] to which all eight of the Arctic states are parties, also promotes the creation of MPAs. Article 2 of the convention requires parties to protect "geological and physiographical formations and precisely delineated areas which constitute the habitat of threatened species of animals and plants of outstanding universal value from the point of view of science or conservation." As the World Heritage Marine Programme reveals,[34] marine areas are poorly represented, with only 47 sites designated out of over 1007 listed properties worldwide.[35] Only three natural properties within the AMAP "Arctic Boundary" and with a marine component have been registered on the World Heritage list: the Kluane/Wrangell-St. Elias/Glacier Bay/Tatshenshini-Alsek National Parks and Protected Areas along the boundary of Canada and the United States (1979); Russia's Wrangel Island Reserve (2004); and the Icelandic volcanic island Surtsey, which includes a small surrounding maritime area (2008).[36] A 2013 United Nations Educational, Scientific, and Cultural Organization (UNESCO)-sponsored report on world heritage marine sites highlighted the need for future actions to recognize the unique heritage of the Arctic region: "A recent, preliminary stock take indicated nine major marine gaps on the World Heritage List. The Arctic Realm might be of special interest. Nearly no World Heritage sites exist anywhere along the vast and distinct Arctic coastlines but this region contains many exceptional marine features."[37]

UNESCO's Man and the Biosphere (MaB) Programme, an intergovernmental scientific program, was launched in 1972. A key component of the MaB program is the designation of biosphere reserves to promote "sustainable development based on local community efforts and sound science."[38] The designation process, from the selection of sites to the creation of regulatory mechanisms and the subsequent monitoring of activities, remains entirely under the sovereign jurisdiction of the participating states. All the Arctic states have established MaB national committees and Canada, Finland, Russia, and the United States have designated MaB reserves. However, though there are approximately 651 biosphere reserves in 120 states,[39] only two of the MaB reserves are both situated within AMAP's "Arctic Boundary" and have a marine component: Alaska's Aleutian Islands (1976) and Glacier Bay—Admiralty Islands (1986).

The International Convention for the Prevention of Pollution from Ships (MARPOL),[40] with its six technical annexes, is the main international treaty covering the prevention of pollution by ships from operational or accidental causes. In regards to the protection of sensitive marine ecosystems, MARPOL provides for the designation of "special areas"[41] within which higher standards can apply for discharges of oily residues (annex I), noxious liquid substances (annex II), sewage (annex IV) and garbage (annex V). MARPOL also regulates Emission Control Areas for certain pollutants released atmospherically (annex VI). Although all of the Arctic states are parties to MARPOL, their subscription to optional annexes III–VI[42] is slightly more varied. All eight states have accepted annexes III and V; however Iceland and the United States are not parties to annex IV, and Iceland is also not a party to annex VI.[43]

In November 2001, the assembly of the International Maritime Organization (IMO) adopted new Guidelines for the Designation of Special Areas under MARPOL.[44] These guidelines aim to provide guidance to parties in the formulation and submission of applications for the designation of special areas under the various annexes. To obtain special area designation, a proposing government must show that basic MARPOL requirements do not provide adequate protection for the identified area. In accordance with paragraph 2.2, a special area may encompass the maritime zones of several states, or even an entire enclosed or semi-enclosed sea, including marine areas beyond national jurisdiction.[45] However, a designation cannot enter into force unless there are adequate reception facilities available in the area that can receive the particular harmful substance from affected ships.[46] Although twenty MARPOL special areas have now been designated under technical annexes I, II, IV, and V as well as four emission control areas under annex VI, none of them are within the AMAP "Arctic Boundary."[47]

The IMO also provides guidance on another related concept: the designation of particularly sensitive sea areas (PSSAs). Paragraph 1.2 of the PSSA Revised Guidelines[48] defines a PSSA as "an area that needs special protection through action by IMO because of its significance for recognized ecological, socioeconomic or scientific attributes where such attributes may be vulnerable to damage by international shipping activities." As

Tanaka has emphasized, "with respect to spatial scope, PSSAs may cover all marine spaces including the high seas."[49] Paragraph 1.4 of the revised guidelines expressly states that their purpose is first, to provide guidance to IMO member states wishing to designate an areas as a PSSA; second, to ensure a balanced consideration of all interests at stake (those of the coastal states and flag states as well as those of the environmental and shipping communities); and third, to provide a set of criteria for the IMO's assessment of applications.[50]

Only the IMO can designate areas as PSSAs. Consequently, members wishing to make a proposal must submit an application to the IMO's Marine Environment Protection Committee (MEPC) on the basis of the three types of criteria identified in the guidelines: (1) ecological criteria; (2) social, cultural, and economic criteria; and (3) scientific and educational criteria.[51] Every application for a PSSA designation must also identify an associated protective measure (APM) to be approved by the appropriate IMO body. Section 6 of the revised guidelines stipulates that associated protective measures (APMs) for PSSAs are limited to actions "that are to be, or have been, approved or adopted by IMO" and include three options:

- designation of an area as a special area under MARPOL annexes I, II, or V or an SO_x (sulfur oxides) emissions-control area under MARPOL annex VI, or application of special-discharge restrictions to vessels operating in a PSSA;
- adoption of ships' routing and reporting systems near or in the area, under the International Convention for Safety of Life at Sea (SOLAS) and in accordance with the General Provisions on Ships' Routing and the Guidelines and Criteria for Ships Reporting Systems; and
- development and adoption of other measures aimed at protecting specific sea areas against environmental damage from ships, provided that they have an identified legal basis.

There are at present fifteen PSSAs in the world, but none of them is in the Arctic.[52]

A more general framework for the regulation of the world's oceans was put into place with the adoption of the United Nations Convention on the Law of the Sea (UNCLOS).[53] The 166 parties to the convention include all the Arctic states except the United States.[54] Article 192 of the convention, the lead-off article under part XII dedicated to the "Protection and

Preservation of the Marine Environment" stipulates unequivocally: "States have the obligation to protect and preserve the marine environment." The various responsibilities and prerogatives of the parties are then fleshed out in a series of provisions, including the possibility under article 211(6) for coastal states to adopt special measures addressing vessel-source pollution in designated areas of their exclusive economic zone (EEZ). To date, there has been no "clearly defined area" designated in the Arctic or elsewhere in the world specifically on the basis of this provision of UNCLOS. Therefore, the effectiveness of this mechanism remains to be tested.[55]

The adoption of the Convention on Biological Diversity (CBD)[56] in 1992 also marked a departure from issue-specific agreements and served to better define the duties weighing on individual states with respect to the conservation of biological diversity and the fair use of their resources.[57] Canada, Denmark, Finland, Iceland, Norway, Russia, and Sweden are all parties to the CBD; the United States, while a signatory, has not ratified the convention. The CBD contains a strong emphasis on the establishment of protected areas.[58] Article 8 imposes on contracting parties the duty to establish "as far as possible and as appropriate," "a system of protected areas or areas where special measures need to be taken to conserve biological diversity." These protected areas, as described in annex I, can be designated to help conserve certain species and communities that are threatened as well as ecosystems and habitats containing high or unique biodiversity.

The CBD website provides information on the implementation of its provisions by parties. For example, the country profile for Iceland reveals that "in 2000, the 85 national parks and reserves and other protected areas amounted to roughly 11,900 km^2, or approximately 12 percent of the total land area in Iceland. It is estimated that 6 percent of protected areas classify as wetlands, and that approximately 4.5 percent of the wetlands in Iceland have been protected."[59] Russia's profile on the CBD website identifies the priorities of the "National Strategy of Biodiversity Conservation in Russia" as "species and ecosystems conservation while focusing on priorities, challenging economics and other activities, and developing the Network of Specially Protected Natural, Historical and Cultural Territories." The establishment of a network of research centers for the conservation of rare species of animals is listed among the achievements of the new Russian national strategy, as is "an increase in the area of Specially Protected Areas which rose from 2 percent to 2.8 percent of the total area of the country."[60]

Under the section "Action taken to achieve the 2020 Aichi Biodiversity Targets,"[61] the following information on Russian initiatives is provided:

> *The entirely natural ecosystems of Russia and their biological diversity are conserved in nearly 15,000 specially protected natural territories of various statuses, occupying more than 10 percent of the country's area. They include 101 federal reserves and 40 national parks however are distributed unevenly and do not comprehensively reflect the natural diversity of regions. Currently, there are more than 100 identified "hot spots" in the Arctic Zone of the Russian Federation, 30 of which have urgent environment issues.*

Similar information is provided in the country profiles for the other Arctic state parties:

- Norway: "In terms of habitat and species conservation, almost 17 percent of the Norwegian mainland and 65 percent of the Svalbard (Arctic) region is at present protected by means of national parks, nature reserves or other conservation areas."[62]
- Sweden: "Significant progress has been made in regard to the protection of a wide range of particularly important habitats, such as old-growth forests, species-rich meadows and pastures on semi-natural grasslands, wetlands, mountains, lakes, rivers and marine habitats."[63]
- Finland: "Finland's network of protected areas is quite extensive, with some 12 percent of the country's total surface under protection, and up to 15 percent when other areas reserved for nature conservation programs are added, including the Natura 2000 sites which encompass significant areas for marine and coastal biotopes and species."[64]
- Denmark: "To date, Denmark has protected more than 11 percent of its total land area, one third of which is classified as IUCN Categories I and II. The Natura 2000 network comprises in total 16,638 km^2: 3,591 km^2 are terrestrial (8.4 percent of land base) and 13,047 km^2 are marine (12.3 percent of marine area)."[65]
- Canada: "One of the most significant results achieved regarding the Aichi targets is the addition to Canada's networks of protected areas, with approximately 9.4 percent of Canada's terrestrial area currently

> protected . . . However, despite the recent increased attention on marine protected areas, only 0.64 percent of Canada's ocean area is now protected."[66]

While important initiatives have been undertaken at the national level by all seven of the Arctic state parties, it is clear from the country profiles that efforts in regards to protecting *marine* areas lag behind terrestrial measures. Furthermore, Arctic marine protected areas appear to be severely underrepresented.

REGIONAL AGREEMENTS/ARRANGEMENTS

From the beginning, the Arctic Environmental Protection Strategy (AEPS)[67] identified as a guiding principle the development of a network of protected areas with due regard for the needs of indigenous peoples.[68] This important task was assigned to the Working Group on the Conservation of Arctic Flora and Fauna (CAFF) at the ministerial meeting held in Nuuk in 1993. In response to this challenge, CAFF presented in 1996 the Circumpolar Protected Areas Network (CPAN) Strategy and Action Plan[69] along with the CPAN Principles and Guidelines.[70]

According to the strategy and action plan, the main goal of CPAN was "to facilitate the implementation of initiatives to establish, within the context of an overall Arctic habitat conservation strategy, an adequate and well managed network of protected areas that has a high probability of maintaining the dynamic biological diversity of the Arctic region in perpetuity." To achieve this goal and fully implement the CPAN, the Strategy and Action Plan outlined actions required at both the national and regional level, including the need to explore the prospects for protecting international waters and establishing or expanding transboundary protected areas or other areas of mutual interest. The CPAN Principles and Guidelines specifically addressed the issues of governance and effectiveness and proposed a common set of guidelines for selecting sites, "including the use of buffer zones and the application of the 'corridor concept,' the principle of connectivity and the 'cluster principle.'"[71]

While CPAN dominated CAFF's agenda at the outset, a change in priorities was evident in the progress report submitted to the 1997 ministerial meeting in Alta. A new overarching document, the *Co-*

operative Strategy for the Conservation of Biological Diversity in the Arctic Region, was identified as the primary guide to the working group's future activities.[72] Nevertheless, at the seventh meeting of CAFF's International Working Group in 1999, a standing committee was established for the CPAN and the group nominated the United States to lead the committee and the CPAN project in general.[73] By 2002, the CPAN expert group had a draft charter at its disposal,[74] and by November 2004 had produced a *Country Updates Report* that clearly showed that the Arctic countries had made significant progress in establishing protected areas contributing to a circumpolar network and had improved the legislative and policy bases for managing such areas.[75] However, in 2005, the CPAN network became dormant.[76]

In line with its new priorities presented at the 1997 Alta ministerial meeting, CAFF has since focused on programs to monitor circumpolar biological diversity. In particular, the Circumpolar Biodiversity Monitoring Program (CBMP), launched in 2004 and aimed at producing reports on how Arctic biodiversity is changing, especially in light of climate change, has become CAFF's cornerstone program. Its 2010 Arctic Biodiversity Trends . . . report—a component of the Arctic Biodiversity Assessment—included a protected areas indicator and thus, arguably, contributed to achieving CPAN's goals.

However, while CAFF's monitoring and assessment activities no doubt contribute to overall efforts aimed at protecting Arctic marine biodiversity, the task of helping to establish a network of MPAs in the region has now fallen to PAME. Specific priorities for the group's work were identified at the 1996 Inuvik ministerial meeting, including the development of a regional program of action for the protection of the Arctic marine environment from land-based activities as well as guidelines for offshore petroleum activities.[77] Successive ministerial meetings, 1998 (Iqaluit) and 2000 (Barrow), confirmed the priorities identified at Inuvik and directed PAME to assess current and potential impacts of shipping activities in the Arctic. At the 2002 Inari ministerial meeting, PAME was requested to develop a strategic plan for the protection of the Arctic marine environment, "which would be used to lay the foundation for a more coordinated and integrated approach to managing the challenges of the Arctic coastal and marine environments."[78]

In response, PAME developed an Arctic Marine Strategic Plan (AMSP)[79] that was adopted at the November 2004 ministerial meeting in Reykjavik and that Koivurova has described as the working group's most ambitious initiative.[80] The strategic plan identified a range of priority actions including the promotion of "WSSD [World Summit on Sustainable Development (UN)] actions related to the marine and coastal environment, including the application of an ecosystem approach and establishment of marine protected areas, including representative networks."[81] These goals were reiterated in PAME's recently updated AMSP for the period 2015–25, which lists as one of its "Strategic Actions" the development of "a pan-Arctic network of marine protected areas, based on the best available knowledge to strengthen marine ecosystem resilience and contribute to human well-being including traditional ways of life."[82]

The Arctic Marine Shipping Assessment (AMSA) was a direct follow-up to the 2004 AMSP, specifically "Strategic Action 7.1.5: Conduct a comprehensive assessment of Arctic marine shipping at current and projected levels." The 2009 AMSA report[83] identified a number of recommendations including recommendation IIC under the theme "Protecting Arctic People and the Environment":

> *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.*

An AMSA IIC project was subsequently established with Norway, Canada, Denmark/Greenland, and the United States as lead countries and assistance from AMAP, CAFF, and the SDWG (the Sustainable Development Working Group). As the preface of the 2013 project report explains,[84] although it was initially intended that the identification of areas of heightened ecological and cultural significance would be addressed in a similar fashion, this ultimately proved impossible.[85] Noting that the information on culturally important areas is "fragmented, incomplete and inconsistent across jurisdictions," the introduction to part B of the report states that "a comprehensive catalogue of areas of heightened cultural significance cannot yet be compiled."[86]

Areas of heightened ecological significance are identified in the 2013 report for each of sixteen large marine ecosystems (LMEs) within the Arctic area. The executive summary describes the three different approaches used to identify such areas: (1) areas identified as vulnerable areas in the AMAP assessment of oil and gas activities in the Arctic were used as the basis for "AMSA IIC" areas in eleven LMEs (located in the Northeast Atlantic sector, in the Russian Arctic, Bering and Chukchi Seas, and the Central Arctic Ocean); and (2 and 3) Canada and Denmark/Greenland had separate national processes to identify areas of heightened ecological significance for their waters (five LMEs, from the Beaufort Sea to the Greenland Sea).[87] While the report assigns primary relevance to the IMO criteria for particularly sensitive sea areas (eleven ecological, three socioeconomic, and three scientific criteria), it also refers to the set of criteria adopted by the Convention on Biological Diversity for identifying ecologically and biologically significant areas (EBSAs) and the IUCN criteria for selecting marine protected areas (MPAs).

The report identifies approximately ninety-seven areas of heightened ecological significance within the Arctic LMEs comprising a total area of about 12 million km^2, or more than half the total area of the ice-covered part of the marine Arctic.[88] However, it must be emphasized that the report addresses only the first part of AMSA recommendation IIC—the *identification* of areas of heightened ecological and cultural significance; the preface asserts that the report is intended only to provide the scientific basis for the *eventual consideration* of protective measures by the Arctic states and permanent participants.

In March 2014, a separate report was released on "Specially Designated Marine Areas in the Arctic High Seas."[89] The study, by Det Norske Veritas (DNV) on behalf of PAME with financial support from the Norwegian Ministry of Foreign Affairs, was conducted as a follow-up to AMSA recommendation IID:

> *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.*[90]

Part I of the DNV report deals with the need to protect Arctic high seas areas in regards to two main issues: (1) maritime traffic and risk levels, present and future; and (2) the vulnerability of biological resources.[91] One of the main findings of this first section is that "even if the vulnerability of the area is evident, there are significant limitations to the present state of knowledge."[92] Part II of the report reviews available IMO measures and, based on this review of available designated areas mechanisms, combined with the environmental conditions and the potential for ship traffic in the Arctic high seas, concludes that it is difficult to envisage a special-area designation under MARPOL.[93] However, the authors of the report do find some support in favor of a PSSA designation and argue that the most feasible option would be to establish a "core sea ice area" as a sanctuary for unique and vulnerable Arctic high seas ecosystems. A prohibition on vessel traffic in this core area as an associated protective measure would ensure protection without unduly impeding movement in other areas.[94]

A number of sub-regional bodies are also involved in the governance of the Arctic marine environment. One such important institution is the forum for intergovernmental and interregional cooperation in the Barents region, the Barents Euro-Arctic Region (BEAR), which covers the northern parts of Finland, Norway, and Sweden as well as the northwest regions of Russia. Formally established by the Kirkenes Declaration[95] in 1993, BEAR has governance structures at both the national and regional levels: the Barents Euro-Arctic Council (BEAC), whose member states are Denmark, Finland, Iceland, Norway, Russia, Sweden, and the European Union, and the Barents Regional Council for the Euro-Arctic Region (BRC), which includes input from thirteen counties. In addition, representatives from the Sami, Nenets, and Vespian peoples serve in an advisory capacity in both councils and also participate in a working group of the BRC.[96]

Although the Kirkenes Declaration makes no reference to the marine environment, working groups and task forces have been established by both the BEAC and the BRC to deepen cooperation, including in regards to the environment. BEAC's working group on the environment (WGE) has identified as an important challenge for the prosperity of the region, the promotion "of responsible, sustainable and environmentally sound economic activities."[97] In pursuit of that goal, it has created a subgroup on nature protection. Recognizing that the Barents Region is a continuous geographical area, the nature protection subgroup has adopted as its principal project the Barents Protected Areas Network (BPAN).[98]

The primary aim of the BPAN project is to promote and support the development of a representative protected area network in the Barents Euro-Arctic Region to conserve biodiversity of boreal and Arctic ecosystems, particularly forests and wetlands.[99] A map of BPAN pilot sites[100] reveals, however, that, to date, the marine component in existing protected areas has been negligible. However, the "planned protected areas" shown on the BPAN map do seem to include a greater number of coastal areas.

The European Commission's Environment website describes Natura 2000 as "the centerpiece of EU nature and biodiversity policy."[101] It is a European Union-wide network of nature protection areas, including in the marine environment, comprised of special areas of conservation (SAC) designated by member states under the 1992 Habitats Directive, and special protection areas (SPAs) that states designate under the 1979 Birds Directive. The Natura 2000 Barometer[102] gives updated statistical information on the progress in establishing the network; the most recent figures are based on national data provided until the end of December 2013. The barometer provides the following statistics in terms of marine sites (sites having a marine-area component covering more than 5 percent of their total area) for the three Arctic members:

- Denmark: 101 special area of conservation (SAC) marine sites under the Habitat Directive and 57 special protection area (SPA) marine sites under the Birds Directive;
- Finland: 142 SAC marine sites and 87 SPA marine sites; and
- Sweden: 451 SAC marine sites and 138 SPA marine sites.

While the rate of participation of Denmark, Finland, and Sweden is extremely positive, the marine sites established are necessarily geographically restricted in regards to the Arctic region as a whole. The Natura 2000 sites are also fairly narrow in focus, concerned with the protection of specific species or habitats.

The global framework of fisheries instruments[103] mandates that regional fisheries management organizations and arrangements, and bilateral fisheries instruments, play a lead role in the management of straddling, highly migratory, and transboundary stocks. A number of fora therefore exist to manage most current Arctic fisheries. Furthermore, although no pan-Arctic fisheries management agreement exists for the central Arctic

Ocean, relevant fisheries bodies exist for part of the high seas areas of the Arctic and sub-Arctic. These agreements and arrangements apply to “clearly defined geographical spaces” and are “recognized, dedicated and managed through legal or other effective means, to achieve the long-term conservation of nature”[104] and therefore meet the generally accepted definition of marine protected areas. Among such fora are the Northwest Atlantic Fisheries Organization (NAFO),[105] the North Atlantic Salmon Conservation Organization (NASCO),[106] and the North East Atlantic Fisheries Commission (NEAFC).[107] Bilateral arrangements include the fisheries regime between Norway and Russia in the Barents Sea[108] and between the United States and Russia in the North Pacific Ocean and Bering Sea.[109]

With regards to the conservation and management of marine mammals, the Agreement on Cooperation in Research, Conservation and Management of Marine Mammals in the North Atlantic[110] established a regional organization, the North Atlantic Marine Mammal Commission (NAMMCO).[111] The parties to the agreement are the Faroe Islands, Greenland, Iceland, and Norway—with Canada, Denmark, the Russian Federation, and Japan participating as observers. NAMMCO’s objective is to contribute, through regional consultation and cooperation, to the conservation, management, and study of marine mammals, including large whales, smaller cetaceans, and pinnipeds, in its area of concern. With respect to Arctic species, NAMMCO cooperates with the Joint Canada-Greenland Commission on Beluga and Narwhal through a joint scientific working group with the mandate to provide conservation and management advice.[112]

COMMENTARY

The eight Arctic states have pledged under various international and regional agreements and arrangements to contribute and cooperate in the conservation of the Arctic’s diverse biosystems through a variety of mechanisms, including establishing protected areas for ecosystem, habitat, and species protection. Annex 4 to PAME’s recent “Arctic Marine Strategic Plan 2015–25,” which provides detailed information on existing and planned MPAs in the Arctic EEZs of Canada, Denmark/Greenland, Iceland, Norway, Russia, and the United States, attests to the progress that has been achieved. Annex 4 tables, based on information provided by the states themselves and divided into three separate headings (existing MPAs, planned MPAs, and other area-based conservation measures), reveal that existing Arctic MPAs encompass a broad range of protection objectives from multiple-use areas to "no take" areas where extractive uses are prohibited.[113]

Worldwide, MPAs are recognized by nations as valuable science-based resource-management tools supporting ecosystem-based conservation, capable of reconciling the cumulative impacts of different sectors with the goal of "maintaining ecosystems in a healthy, productive and resilient condition so that they can provide the services humans want and need."[114] An MPA network, one of the key goals of PAME's Arctic Marine Strategic Plan, is "a system of individual marine protected areas defined by connectivity and operating cooperatively, at various spatial scales, with a range of protection levels that fulfill biodiversity goals and objectives more effectively than individual sites could alone."[115] According to research material produced by the Coastal Conservation and Education Foundation, these MPA networks can take various forms:

> *There are social networks formed by communication and sharing of results and coordination of administration and planning. There are ecological networks formed by ensuring that natural connections between and within sites enhance ecological functions and benefit one or more MPAs. There are management-based networks formed by creating consistency and efficiency in areas such as enforcement, monitoring and awareness building.*[116]

However, as the authors emphasize, all three types of networks—social, ecological, and management-based—need to be *integrated* and *coordinated* to maximize their potential benefits.

Despite the recognized advantages of integrated networks of MPAs as effective tools for the conservation of the biological diversity and productivity of the oceans, there is currently no effective and representative network of MPAs in most or all of the Arctic marine area.[117] The challenges involved in establishing, coordinating, and monitoring such a "pan-Arctic network of marine protected areas"[118] are daunting.

As is clear from the various MPAs established to date by the Arctic states in their EEZs, management objectives can range from requiring preservation to allowing sustainable use. In this way, explains

Jennings, "[t]he selected management objectives determine whether marine environmental management will be dubbed 'management' or 'conservation.'"[119] Thus, within MPAs, levels of protection can range from limitations on fishing and other human activities to complete prohibition of any forms of use or extraction (also known as "no-take" zones).

In Canada, the 1996 Oceans Act[120] is based on the principles of sustainable development, integrated management, and the precautionary approach. From the start, marine protected areas were envisaged as a critical management strategy to promote Canada's vision for healthy oceans. The Department of Fisheries and Oceans (DFO) 1999 National Framework for Establishing and Managing Marine Protected Areas[121] recognized that in order to allow for regional flexibility and to suit local needs, the conservation and management goals of individual MPAs would necessarily vary throughout Canada. To accommodate the wide range of goals, management plans for MPAs were thus to be developed on a case-by-case basis in cooperation with local resource users and interested and affected parties. Indeed, the DFO guidelines explicitly recognized that partnering and cooperation between the various stakeholders were vital to Canada's MPAs program. This emphasis on transparency and inclusiveness is also present in later documents, more explicitly focused on the need to build *a network* of MPAs: the Federal Marine Protected Areas Strategy (2005),[122] Canada's Oceans Action Plan (2005),[123] and the National Framework for Canada's Network of MPAs (2011).[124]

However, the task of reconciling existing human activities with conservation strategies and priorities has proven to be a long and arduous process. There have been significant disagreements about the desired objectives of proposed MPAs within Canada. The creation of the Tarium Niryutait MPA, which covers approximately 1,800 km^2 of the Mackenzie River Delta and estuary in the Beaufort Sea, is a telling example.[125] Officially announced on 26 July 2010, the Tarium Niryutait MPA was created following a lengthy consultative process between Fisheries and Oceans Canada, the Inuvialuit people, private industry, local stakeholders, and governments. The difficulties inherent in reconciling competing interests and goals were strongly emphasized in the 2012 *Annual Report of the Commissioner of the Environment and Sustainable Development* (CESD), which specifically included an audit of the actions taken by Fisheries and Oceans Canada and Parks Canada to plan, establish, and manage MPAs.[126]

> *(3.27) When establishing MPAs, the entities consult and negotiate extensively with multiple authorities and stakeholders. Federally, consultations may occur with other federal departments, including Natural Resources Canada, Transport Canada, and Aboriginal Affairs and Northern Development Canada. Other authorities and stakeholders can include provincial governments, joint federal-provincial bodies, such as the offshore petroleum boards, aboriginal peoples, environmental organizations, and affected industries, like oil and gas, fishing, and tourism. Critical aspects of the establishment process, such as the time required for consultation and negotiation with other authorities and stakeholders, for ministerial approval, and for the legislative process, are unpredictable and outside the direct control of program managers at Fisheries and Oceans Canada or Parks Canada. As a result, the establishment process typically takes years, if not decades, to complete.*[127]

If such difficulties are encountered at the national level in trying to define what should be the objectives of MPAs and what form they should take, and knowing that decisions in one location can drastically impact the marine environment in other locations, how are different visions to be reconciled at the circumpolar level? Nationally devised MPAs will necessarily reflect varying priorities, investments, and governance structures and may well lead to a patchwork of inconsistent and therefore ineffective initiatives.

These challenges are acknowledged in PAME's recent "Framework for a Pan-Arctic Network of Marine Protected Areas" (April 2015) along with other pressing issues of concern: "limitations in the availability of scientific information, diverse and widely dispersed stakeholder communities, variability in governance regimes and national priorities, sustainable funding, and shifting environmental baseline." [128] However, while recognizing that these challenges "are real and in some cases considerable," the report asserts that "progress can be made through strategic and targeted collaboration on shared priorities."[129]

Nevertheless, Jennings' warning must be heeded: The term MPA is currently being used to refer to areas that have been designated rather than to "areas where there have been measurable changes in human pressure."[130] The actual designation of an area to be protected as an objective "puts the emphasis and energy of the political process on designating areas rather than the more difficult task of ensuring that management actions . . .

actually reduce or modify human impacts and create an environment that meets the desired objectives."[131] He cites the Galapagos Marine Resources Reserve as a case in point. "Currently, it is the world's fifth largest area designated as an MPA and a World Heritage Site but there has been almost no capacity to control illegal fishing."[132] To borrow Aldo Chircop's expression, many of the current MPAs are merely "desktop MPAs."

Even if different visions or political choices among all the concerned actors and stakeholders can be accommodated at the national and then subsequently at the circumpolar level, the Canadian experience has also shown that the task of coordinating the multiple agencies involved is another significant challenge. A serious obstacle in implementing the Canadian MPA program has been the difficulty in coordinating the various departments with responsibilities over marine areas. The Oceans Act gives the Minister of Fisheries and Oceans the authority to coordinate all federal marine activities, including the establishment of marine protected areas. However, Environment Canada and Parks Canada are also involved in establishing and operating MPAs.[133] The development of a circumpolar network of MPAs is bound to be complicated by the mix of national and international agencies and jurisdictions with responsibilities in the region.

To be effective, a pan-Arctic network of MPAs will also have to address a number of other transboundary problems. Important jurisdictional issues will have to be resolved or managed so that they do not hinder efforts aimed at developing effective management strategies for the various MPAs within the network. The "Barents Sea Loophole" regime is one example of the complexity of the issues facing those who attempt to manage a drastically changing fishery that straddles both international and national waters.

The Secretariat of the Convention on Biological Diversity has identified another challenge: "the mobility of threats; that is, pollution or other threats arising from activities outside a marine protected area but which have harmful effects within it."[134] In its 2005 report, the secretariat also warns that the mobility of marine species will be a further significant challenge.

> *While some species like sea turtles, marine mammals and certain fish are highly migratory, others may disperse larvae at a certain stage of their life cycle that range far from later feeding and breeding areas. Both require a systematic approach to habitat protection throughout their range, linking*

different habitat areas into networks and corridors of larger, often regional scale. For many species found beyond national jurisdiction, this will also involve areas within national jurisdiction.[135]

A related concern is the unintentional adverse effects an MPA can have on fish stocks. An increase in the concentration of fishing activities at the boundaries of protected areas may well wipe out an MPAs' fishery benefits. For this reason, Côté and Finney warn that MPAs must be large enough "not to risk becoming a genetic bottleneck, and adjacent areas should never be allowed to be degraded to such an extent that it would affect the species and the habitats meant to be protected."[136] For this reason, the implementation of MPAs will likely have to be done in association with other management tools "such as effort reduction, catch quotas and closed seasons in adjacent areas."[137]

The pan-Arctic network of MPAs must build on the work already undertaken by AMAP, CAFF, and the SDWG to identify Arctic marine areas of heightened ecological and cultural significance. The difficult choices and hard compromises that lie ahead must at least be based on the best possible information and statistical data. For this reason, the Arctic states should heed the recommendation in *The Arctic Ocean Review Project 2009–2013: Final Report 2011–2013* to assist, as appropriate, the permanent participants "with the documentation of current and historical a) timing and geographical extent of local uses of the marine environment, and b) levels of traditional marine resources harvests, taking into account the differing documentation needs and capacities of Arctic States."[138] The Arctic states should also address the inconsistencies and gaps in data quality highlighted by the AMSA IIC report in regards to areas of heightened cultural significance. Perhaps the best way to begin the arduous task of devising a coordinated and representative network of marine protected areas in the Arctic is to focus on areas beyond national jurisdiction (ABNJs). International momentum in favor of strengthening the protection afforded such areas is building[139] and perhaps the eight Arctic states could more easily agree on a common vision and on management/conservation goals for such areas. For without an effective strategy, the Arctic states will be unable to meet the formidable challenges of failing ocean health and growing conflicts among oceans users.

There can be little doubt that one of the best examples of a comprehensive, effectively managed, and ecologically representative regional system of MPAs is the OSPAR (original Oslo and Paris Conventions) network in the Northeast Atlantic. The OSPAR Convention (Convention for the Protection of the Marine Environment of the North-East Atlantic)[140] combines and updates the Oslo Convention[141] and the Paris Convention.[142] However, with its focus on the protection and conservation of ecosystems and biological diversity, the OSPAR Convention "represents a step beyond the pollution-prevention goal of both the Oslo and Paris Conventions."[143] The OSPAR maritime area is divided into five distinct regions: Arctic Waters, Greater North Sea, Celtic Seas, Bay of Biscay and Iberian Coast, and the Wider Atlantic.[144]

The central aim of the OSPAR Convention is to prevent pollution and protect the marine environment from all human activities that impact upon it, although fisheries and transport are outside of its mandate. Fisheries management in the OSPAR maritime area is within the remit of the relevant regional fisheries management organization (RFMO), in particular the North East Atlantic Fisheries Commission (NEAFC), the European Union, and national authorities. As for the regulation of shipping activities, the OSPAR Commission relies on the IMO, an observer to the commission.[145]

The OSPAR Commission is the forum through which the parties cooperate; it can adopt legally binding decisions as well as recommendations and guidelines.[146] Article 10 of the OSPAR Convention stipulates that the commission has duties to supervise the implementation of the convention and generally to review the condition of the maritime area, the effectiveness of the measures being adopted, the priorities, and the need for any additional or different measures. To enable the commission to fulfill its mandate, article 22 requires the parties, which include five of the Arctic states,[147] to report to the commission at regular intervals on the legal, regulatory, and other measures taken by them for the implementation of the convention and any decision or recommendation adopted pursuant to the convention. According to OSPAR Executive Secretary Dr. Darius Campbell, "every OSPAR measure has its implementation, reporting and assessment procedures."[148]

At its 1998 meeting in Sintra, Portugal, the OSPAR Commission agreed to "promote the establishment of a network of marine protected areas to ensure the sustainable use and protection and conservation of marine biological diversity and its ecosystems."[149] This process was subsequently enhanced by the 2003 Bremen ministerial statement which committed the commission members to the establishment by 2010 of *a joint network* of well-managed and ecologically coherent marine protected areas.[150] OSPAR Recommendation 2003/3 provided that, beginning in 2006, commission members should report at the end of each calendar year to the commission on any OSPAR MPAs they had selected and on any corresponding management plans they had adopted or amended during that year. In 2006, the OSPAR Biodiversity Committee agreed that annual reports on the status of the OSPAR MPA network itself should also be prepared.

As the objective of a joint network of well-managed MPAs had not been achieved by 2010, the OSPAR ministerial meeting in Bergen in September 2010 adopted a consolidated version of recommendation 2003/3 that included renewed targets: "to continue the establishment of the OSPAR Network of Marine Protected Areas in the North-East Atlantic and to ensure that by 2012 it is ecologically coherent and that by 2016, it is well managed."[151] The commission members also agreed to continue with the preparation of annual reports with a view to tracking progress as well as identifying any shortcomings. The latest status report on the OSPAR MPA network, available on the commission's website, reflects the situation as of 1 October 2014 and contains a wealth of detailed information.[152] Further "key figures" on the MPA OSPAR network are also available on the OSPAR website.[153]

The first section, "OSPAR MPAs under National Jurisdiction," gives statistics for each of the members in regards to the number of MPAs established, their coverage in territorial waters, and in the EEZ. By 1 October 2014, Denmark had nominated thirty-four sites, which covered 6,954 km^2 of its territorial waters and 5,536 km^2 of its EEZ. However, according to the maps included in the report, none of the thirty-four MPAs established at the time were off the coasts of Greenland. Iceland had nominated fourteen MPAs with only 90 km^2 of coverage in its territorial sea and 476 km^2 in its EEZ. The statistics for Norway show twelve sites covering a staggering 83,047 km^2 of territorial waters and 2,408 km^2 of EEZ. While Sweden had nominated ten MPAs, they only covered 1,114 km^2 of Swedish territorial waters and 1,364 km^2 of EEZ.[154]

The 2014 status report explains that coverage of the Arctic Waters (OSPAR Region I) by OSPAR MPAs is almost entirely due to the designation of two extensive sites around the Svalbard archipelago, namely "Svalbard West, Svalbard East" (Norway) and the MPA site "Jan Mayen" (Norway). Yet despite their impressive dimensions and the addition of the extensive newly nominated site "North-east Faroe-Shetland Channel"

(United Kingdom), the report confirms that Arctic waters show the lowest coverage of the five regions with only 1.95 percent (107,041 km^2) of the area being protected by OSPAR MPAs.[155] Progress is, however, likely to be made in the near future as the OSPAR regime has yielded significant results in other regions. Indeed, the 2014 status report highlights that coverage of the Greater North Sea (Region II) by the OSPAR network (13.83 percent) has reached the target agreed by the WSSD and the CBD to have at least 10 percent of the oceans protected by MPAs. Coverage of the Celtic Seas (III) and the Wider Atlantic (V) is also comparatively good with 6.65 percent and 8.27 percent respectively.[156]

The second section of the 2014 status report concerns what is possibly OSPAR's greatest success story: the establishment of MPAs in ABNJs. Approximately 40 percent of the OSPAR maritime area is beyond the jurisdiction of the coastal states,[157] and there are three high seas areas within the AMAP "Arctic Boundary": the "banana hole" in the Norwegian Sea (269,000 km^2), the "loop hole" in the Barents Sea (66,000 km^2), and an area north of Svalbard.[158] The 2003 Bremen ministerial commitment to establish an ecologically coherent network of well-managed MPAs by 2010 included a clear mandate to identify and designate MPAs in ABNJs.

In 2006, Portugal formally nominated the Rainbow Hydrothermal Vent Field as an MPA within the OSPAR network. While this MPA had originally been considered to be situated in an ABNJ, Portugal considered the site to be situated on its extended continental shelf (ECS). Although Portugal's submission to the United Nations Commission on the Limits of the Continental Shelf (CLCS) of the UN Convention on the Law of the Sea was still in process, in recognition of its obligations under article 192 of the UNCLOS to protect and preserve the marine environment, it agreed to assume responsibility for protecting the seabed and sub-soil even prior to the final conclusion of the UNCLCS process.

At the OSPAR ministerial meeting in 2010 (Bergen, Norway), six proposals for OSPAR MPAs in ABNJs were presented for adoption. Annex III of the 2014 status report summarizes the "historical process of the elaboration of these proposals, including the collation and review of scientific information and data, the preparation of legal feasibility studies and consultations among CPs [contracting parties]."[159] As a result of a multifaceted international cooperative process,[160] and taking into account the complex legal situation arising from submissions to the Commission on the Limits of the Continental Shelf,[161] the OSPAR commission decided to collectively establish the following MPAs in ABNJs in the high seas of the Northeast Atlantic:

- Charlie-Gibbs South MPA (146,030 km^2);
- Milne Seamount Complex MPA (20,914 km^2);
- Mid-Atlantic Ridge north of the Azores High Seas MPA (93,570 km^2);
- Altair Seamount High Seas MPA (4,384 km^2);
- Antialtair High Seas MPA (2,807 km^2); and
- Josephine Seamount Complex High Seas MPA (19,363 km^2).[162]

At the annual meeting of the OSPAR commission in 2012 (Bonn, Germany), the contracting parties collectively agreed to expand the OSPAR network with the designation of the Charlie-Gibbs North High Seas MPA (178,094 km^2), a decision that came into force on 14 January 2013. In conjunction with the decision to establish the six MPAs, the 2010 and 2012 OSPAR ministerial meetings also agreed upon recommendations for the management of each area. The duty that weighs on every commission member to report annually to the commission includes information on actions undertaken to implement those recommendations.

In 2011, the United Kingdom nominated the North West Rockall SAC as an OSPAR MPA, parts of which (covering 181 km^2) extend beyond its EEZ into an area subject to a submission by the United Kingdom to the UNCLCS for an ECS. Then in 2012 and 2014, the United Kingdom nominated two more OSPAR MPAs (Hattan Bank SAC and Hatton-Rockall Basin), entirely located in areas subject to submissions by the United Kingdom to the UNCLCS for an ECS.[163] Thus, by the end of 2014, the OSPAR network of MPAs comprised ten MPAs situated in areas beyond the limits of national EEZs, i.e., the high seas, the "Area," and ECS areas.

As the 2014 status report emphasizes, the ten OSPAR MPAs nominated up to 1 October 2014 in areas beyond the limits of national EEZs can be grouped into different categories with regards to their jurisdictional regime. The first category includes the Charlie-Gibbs South MPA and the Milne Seamount Complex MPA. These two MPAs are situated entirely in ABNJs; the seabed, subsoil, and the water column are protected collectively by all OSPAR contracting parties. The second category is comprised of the Mid-Atlantic Ridge north of the Azores High Seas MPA, the Altair Seamount

High Seas MPA, the Antialtair High Seas MPA, and the Josephine Seamount Complex High Seas MPA. As the authors explain, these four MPAs are situated within an area subject to a submission by Portugal to the UNCLCS for an ECS.

> *Portugal has expressed the intention to assume the responsibility to take measures for the protection of the seabed and the subsoil within these areas. Upon invitation by Portugal, the OSPAR Commission agreed to collectively protect the water column of these MPAs.*[164]

The third category includes the Charlie-Gibbs North High Seas MPA. This MPA is partly situated within an area subject to a submission by Iceland to the UNCLCS for an ECS. The water column is protected collectively by all CPs. The seabed and subsoil remain unprotected. The final category includes the Rainbow Hydrothermal Vent Field, Hatton Bank SAC, and Hatton Rockall Basin. These three MPAs are situated within areas subject to a submission by a CP to the UNCLCS for an ECS. The seabed and subsoil of these sites are protected by the respective CP while the water column remains unprotected.[165]

While none of OSPAR's ten MPAs in areas beyond national EEZs are within the AMAP "Arctic Boundary," the process that has led to their designation should inform efforts at the circumpolar level. Not only have potential overlaps with extended continental shelves not been allowed to derail the process of establishing MPAs in ABNJs but cooperative arrangements have also been actively sought with other international and regional bodies exercising regulatory or management authority in those areas: for example, NEAFC, NASCO, NAMMCO, the International Whaling Commission (IWC), the IMO, and the International Seabed Authority (ISA).[166]

> *Being aware of the shared responsibilities and the need for a collaborative approach in ABNJ/in the High Seas, OSPAR has at the same time aimed at strengthening mutual exchange and cooperation with the various relevant international Competent Authorities responsible for the management of specific human activities . . . This year's (2014) adoption of the collective arrangement between OSPAR and NEAFC on cooperation and coordination regarding selected areas in ABNJ in the North-East Atlantic represents a significant step forward in this process.*[167]

Though there have been some gaps and inconsistencies resulting from the overlay of competences, the memoranda of understanding and agreements on cooperation between the OSPAR commission and these other competent organizations have successfully established a cooperative framework that has enabled the coordination and conciliation of their respective programs and activities (e.g., NEAFC's bottom-fisheries closures). As Molenaar and Elferink have emphasized, annex V of the OSPAR convention allows the commission to adopt programs and measures to safeguard against harm to marine ecosystems and biodiversity resulting from all other existing or new activities.

> *This allows the OSPAR Commission to act as an 'authority by default' in the absence of a competent international organization at the global level and for new and emerging activities. This has led, inter alia, to the adoption of the non-legally binding 'Code of Conduct for Responsible Marine Research in the Deep Seas and High Seas of the OSPAR Maritime Area' in 2008.*[168]

CONCLUSION

From an analysis of global regimes as well as regional arrangements, it is clear that MPAs are playing a significant role in ongoing efforts to safeguard the Arctic marine environment. However, the challenge remains to ensure that those MPAs that have been set up are effectively managed and supervised for the long-term protection of the Arctic's ecosystems. There is also another daunting challenge, perhaps the most formidable obstacle to be overcome: ensuring that the various national, regional, and international measures form an ecologically coherent transboundary network. If the best hope of conserving the Arctic's wealth and beauty lies in adopting a holistic approach, then a coordinating strategy for the region must be devised.

The OSPAR regime, through the work of its commission, has proven that an ecosystem-based management approach to marine conservation is possible, even among a significant number of states. However, regionalism of this type requires a high degree of bilateral and multilateral cooperation in undertaking, coordinating, and implementing MPA-making commitments. A 2010 article analyzing the potential for the establishment of a transboundary network of MPAs in the East African context identifies a number of fundamental elements that must be present for such an ambitious project to succeed.[169]

Chief among the requirements identified by the authors is the need for a governance framework. "An essential aspect of MPA making [. . .] is the governance framework [. . .] Where MPA cooperation has an international dimension [. . .] the governance framework needs to include a [. . .] coordinated legal arrangement."[170] Such a legal arrangement provides legitimacy and "is the springboard for planning, implementation, management and enforcement—all essential elements of effectiveness."[171] There is no equivalent to the OSPAR convention at the circumpolar level. Cooperation within the Arctic Council is instead predicated on the creation of a common knowledge base, the spreading of information on best practices and lessons learned, and the development of policy recommendations for national, regional, and local leaders. While there appears to be an aversion among some of the A8 toward any Arctic treaty proposal,[172] the OSPAR convention, with its *specific, targeted aims* and deference to other competent bodies, should be considered as a plausible and persuasive model.

A corollary to the requirement for a solid legal foundation is the need for an institutional framework that includes, according to the 2010 study, "a clear allocation of a legal mandate for MPA purposes."[173] The functions of the lead institution should include regular monitoring and periodic review to enable an assessment of progress toward conservation targets and outcomes. The designated institution should also be given the authorization to undertake enforcement for, as the authors comment, "enforcement gives fiat to the legal protection of MPAs and avoids the risk of having paper MPAs."[174] PAME's recent "Framework" report acknowledges that developing a pan-Arctic network of MPAs will require "designated points of contact within each Arctic State and a mechanism within the Arctic Council to facilitate ongoing coordination."[175] The report identifies PAME's MPA network expert group as the relevant mechanism to serve this ongoing coordination and network-development function. Obviously, the MPA expert group does not wield the kind of authority exercised by the OSPAR commission. Indeed, as a result of the latter's supervisory responsibilities, it has become an effective centralized coordinating body.

The 2010 article also refers to the need for settled jurisdictional boundaries:

> *Reference to the degree of jurisdictional certainty of each state is pertinent because each of the . . . states will have internal MPA responsibilities up to the limits of its maritime zones, and will need to coordinate the exercise of pertinent legislative and enforcement jurisdictions on its side of the border in cooperation with the neighboring state concerned.*[176]

The settling of overlapping claims to extended continental shelves and the determination of the Canada-United States boundary in the Beaufort Sea might therefore contribute to the effectiveness of an eventual pan-Arctic network of MPAs.

The authors of the report also refer indirectly to the need for a shared vision in terms of both the ecological and the social goals of the network. This may be a significant obstacle in regards to the creation of a pan-Arctic network of MPAs. The success of the OSPAR regime may well be in no small part attributed to the cohesion of its members—all of them European Union member states. The A8 is a more diverse group of states that includes two superpowers and is characterized by varying commitments to the relevant international legal instruments. Their national marine policies and actions also reveal, in some areas, significantly different outlooks and sets of priorities.

Finally, it is essential to provide for effective participatory rights and processes that take into account the expectations of communities, indigenous and others, as well as other stakeholders. This is at least one area where the Arctic Council presents the same strengths as the OSPAR system. It includes the United States, which is not a party to the CBD or the UNCLOS. Whereas the OSPAR convention specifically provides for the participation of other states, such as coastal states outside the OSPAR maritime areas or states whose vessels or nationals are engaged in activities in the OSPAR maritime area, the Arctic Council has welcomed a number of non-Arctic states, intergovernmental, interparliamentary, and nongovernmental organizations as observers.[177] As a process, it also includes the Arctic's indigenous peoples who, as Permanent Participants, can be involved in identifying regional priorities. The Arctic Council's inclusiveness also ensures that the needs, concerns, and knowledge of indigenous peoples can be effectively integrated in the evolving Arctic marine strategy.

The 2011 "Agreement on Cooperation on Aeronautical and Maritime Search and Rescue in the Arctic"[178] has shown the strength of the Arctic states' commitment to multilateral cooperation and their resolve to respond collectively to the many pressing challenges facing the region. Nearly two decades ago, the A8 agreed that the Arctic's vulnerable marine ecosystems warranted a targeted conservation approach that could only be achieved through cooperation.[179] The Arctic Council is the optimal forum to foster such practical cooperation at the circumpolar level, including by facilitating the negotiation of an OSPAR-inspired legal instrument. With an official commitment to effective collaborative action, PAME, as a key agency of the Arctic Council, could then take the lead in devising a coordinated strategy for the implementation of "an adequate and well- managed network of protected areas that has a high probability of maintaining the dynamic biological diversity of the Arctic region in perpetuity."[180]

Notes

1. This paper is an expanded and updated version of "Marine Protected Areas in the Arctic" in A. O. Elferink, E. Molenaar, and D. Rothwell, *The Law of the Sea and Polar Regions: Interactions Between Global and Regional Regimes* (Leiden: Brill Publishers, 2013), 85–111.
2. T. Koivurova, "Alternatives for an Arctic Treaty—Evaluation and a New Proposal" 17: 1 *Review of European & International Environmental Law* (2008): 14.
3. *The Declaration on the Protection of the Arctic Environment 1991* (14 January 1991), available at http://www.arctic-council.org.
4. "Arctic Environmental Protection Strategy: Canada, Denmark, Finland, Iceland, Norway, Sweden, Union of Soviet Socialist Republics, and United States," 14 January 1991, 30 *International Legal Materials (ILM)*: 1624.
5. Ibid., section 2.1(v): 1631. See T. Koivurova and D. L. VanderZwaag, "The Arctic Council at 10 Years: Retrospect and Prospects" *U. B. C. Law Review* 40 (2007): 121 at 124.
6. IUCN/WCPA, Guidelines for *Applying Protected Area Management Categories* (2008), available at data.iucn.org/dbtw-wpd/edocs/PAPS-016.pdf. The Convention on Biological Diversity (CBD) adopted 22 May 1992, entered into force 29 December 1993, 1760 U. N. T. S. 143, provides a slightly different

definition in article 2: “Protected area means a geographically defined area, which is designated or regulated and managed to achieve specific conservation objectives.”

7. Resolution 17.38 (1988) adopted by the General Assembly of the IUCN and reconfirmed in Resolution 19.46 (1994), available at data.iucn.org/dbtw-wpd/html/BP3%20Guidelines_for_marine_protected_areas/Pag-003/Annex%204%20Resolutions%2017.38%20And%2019.46%20Of%20The%20Iucn%20General%20Assembly.html. The CBD also has a specific definition for an marine protected area but uses the broader concept of “marine and coastal protected area” (MCPA) that includes areas lying adjacent to the ocean without necessarily including intertidal or subtidal water.

8. See the International Union for Conservation of Nature and Natural Resources’s Global Protected Areas Program, available at www.iucn.org/about/work/programmes/gpap_home and “Table 5:1: IUCN Protected Area Management Categories” reproduced in Appendix I.

9. Summary provided by UNEP-WCMC, “National and Regional Networks of Marine Protected Areas: A Review of Progress” (2008), available at www.unep.org/regionalseas/publications/otherpubs/pdfs/MPA_Network_report.pdf : 19–20.

10. IUCN-WCPA, *Establishing Marine Protected Area Networks—Making It Happen* (Washington: IUCN-WCPA, NOAA, and the Nature Conservancy, 2008): 6.

11. PAME, “Arctic Marine Strategic Plan 2015–2025: Protecting Marine and Coastal Ecosystems in a Changing Arctic,” approved in April 2015 at the ninth ministerial meeting in Iqaluit, Canada, available at http://www.pame.is/index.php/projects/arctic-marine-strategic-plan.

12. *Ibid*., 6.

13. *Ibid*., 9.

14. The expression is borrowed from F. Côté and J. Finney, “Marine Protected Areas: An Essential Element of the Fisheries Management Toolbox” (2006), available at www.parl.gc.ca/Content/LOP/ResearchPublications/prb0616-e.htm.

15. A. Chircop et al., “Governance of Marine Protected Areas in East Africa: A Comparative Study of Mozambique, South Africa, and Tanzania” Ocean Development and International Law 41 (2010) 1 at 3.

16. Convention on Nature Protection and Wildlife Preservation in the Western Hemisphere, 12 October 1940, entered into force 1 May 1942, 161 *U. N. T. S.* 193.

17. The expression “in their territories” in article II of the convention appears to cover both the internal waters and the territorial sea of the parties.

18. International Convention for the Regulation of Whaling, 2 December 1946, entered into force 10 November 1948, 161 *U. N. T. S.* 72.
19. Preamble.
20. Canada withdrew from the International Whaling Commission in 1982 but has banned commercial whaling in Canadian waters since 1972. China, Japan, and South Korea are also parties to the ICRW.
21. Convention on Wetlands of International Importance, 2 February 1971, entered into force 21 December 1975, 996 *U. N. T. S.* 245.
22. Such sites are designated according to nine criteria, eight of which are biodiversity criteria, emphasizing the importance the convention places on sustaining this biodiversity by designating and restoring wetlands.
23. www.ramsar.org/sites-countries/the-ramsar-sites.
24. rsis.ramsar.org.
25. www.arctic.council.org/images/maps/boundaries.pdf.
26. (1) Dewey Soper, Migratory Bird Sanctuary, NWT (intertidal zone); (2) McConnell River, Migratory Bird Sanctuary, NWT (site includes coastal marshes); (3) Queen Maud Gulf, Migratory Bird Sanctuary, NWT (site includes open sea, coastal bays, intertidal zones, and tidal estuaries).
27. (1) Kitsissut Valley, Qaqortoq (group of thinly vegetated rocky islands 10 km off the southwestern coast several of which are submerged during spring tides); (2) Ikkattoq and adjacent archipelago, Nuuk (shallow tidal fjord); (3) Kitsissunnguit, Qasigiannquit, Aasiaa (site includes shallow sea areas); (4) Aqajarua, Qeqertarsuaq (shallow marine area); (5) Qínnquata Marraa and Kuussuaq, Qeqertarsuaq (site includes extensive intertidal mudflats); (6) Nólsoy, Faroe Islands, Important Bird Area (site includes sea area); (7) Mykines, Faroe Islands, Important Bird Area (site includes sea area).
28. Grunnafjördur, Natural Reserve (river mouth, estuary, and seabay).
29. (1) Slettnes, Finmark, Nature Reserve (site includes coastal meadows); (2) Tanamunningen, Finmark, Nature Reserve (shallow estuary); (3) Stabbursneset, Finmark, Nature Reserve (part of a river delta including shallow marine waters); (4) Reisautløpet, Nordreisa municipality, Nature Reserve (delta ecosystem); (5) Skogvoll, Nordland, Nature Reserve (half the area is made up of shallow marine waters); (6) Balsfojord Wetland System, Troms, Nature Reserve (two large marine tidal areas); (7) Risøysundet, Nordland, Nature Reserve (shallow marine areas); (8) Grunn fjorden, Nordland, Nature Reserve (site includes large intertidal flats); (9) Karlsoyvaer, Nordland, Nature Reserve (marine archipelago); (10) Billesvaer, Nordland, Nature Reserve (site includes shallow marine waters); (11) Røstøyan, Nordland, Landscape Protected Area and Nature Reserve (large archipelago surrounded by shallow marine waters); (12) Dunoyane, Svalbard,

Nature Reserve and National Park (site includes shallow sea areas); Sørkapp, Sørkapp Island, Svalbard, Nature Reserve (site includes shallow and nutrient rich sea areas).

30. (1) Karaginski Island, Korak Autonomous Area, Wildlife Reserve (Karaginski Island and associated marine waters); (2) Kandaksha Bay, Murmansk Oblast, Strict Nature Reserve (inner part of a bay on White Sea); (3) Islands in Onega Bay, White Sea, Karelia, Nature Reserve (sites includes marine waters).
31. Izembek Lagoon, Alaska, National Wildlife Refuge (lagoons and surrounding marshes).
32. UNEP-WCMC, "National and Regional Networks of Marine Protected Areas: A Review of Progress" (2008), available at http://www.unep.org/regionalseas/publications/otherpubs/pdfs/MPA_Network_report.pdf.
33. Convention for the Protection of the World Cultural and Natural Heritage, 16 November 1972, entered into force 17 December 1975, 1037 *U. N. T. S.* 151.
34. World Heritage Marine Programme website at whc.unesco.org/en/marine-programme/.
35. UNESCO/World Heritage Convention website at whc.unesco.org/en/list. The forty-seven marine World Heritage Sites (mWHS) are distributed across thirty-five countries and represent all continents although a large proportion occurs in the tropics (thirty sites or 65 percent). See A. Abdulla et al., *Marine National Heritage and the World Heritage List: Interpretation of World Heritage Criteria in Marine Systems, Analysis of Biogeographic Representation of Sites, and a Roadmap for Addressing Gaps* (Gland, Switzerland: IUCN, 2013), available at https://cmsdata.iucn.org/downloads/marine_natural_heritage_and_the_world_heritage_list.pdf.
36. See the list of mWHS in UNESCO World Heritage Centre—Marine Programme, "Marine World Heritage: Safeguarding the Crown Jewels of the Ocean" (2013), available at whc.unesco.org/document/106793 : 5. Surprisingly, Greenland's Ilulissat Icefjord does not appear on the Marine Programme list but see the detailed description of the site on the main UNESCO list at http://whc.unesco.org/en/list/1149.
37. UNESCO World Heritage Centre—Marine Programme, "Marine World Heritage: Safeguarding the Crown Jewels of the Ocean" (2013), available at whc.unesco.org/document/106793 : 4.
38. Information obtained at www.unesco.org/new/en/natural-sciences/environment/ecological-sciences/biosphere-reserves.
39. UNESCO website at www.unesco.org/new/en/natural-sciences/environment/ecological-sciences/biosphere-reserves/world-network-wnbr/ (information as of 31 October 2015).

40. International Convention for the Prevention of Pollution from Ships, adopted 2 November 1973, as modified by the Protocol of 1 June 1978, entered into force 2 October 1983, and as modified by the Protocol of 26 September 1997, entered into force 19 May 2005; as regularly amended.

41. A special area is defined as "a sea where for recognized technical reasons, in relation to its oceanographical and ecological conditions and to the particular character of its traffic, the adoption of special mandatory methods for the prevention of sea pollution by oil, noxious liquid substances, or garbage, as applicable, is required." Paragraph 2.1, "Guidelines for the Designation of Special Areas under MARPOL 73/78" as set out in Annex I to IMO Assembly Resolution A.927(22) of 29 November 2001, available at http://www.imo.org/blast/blastDataHelper.asp?data_id=10469&filename=927.pdf.

42. Annex III, "Prevention of Pollution by Harmful Substances Carried by Sea in Packaged Form" entered into force on 1 July 1992. It contains regulations which include requirements on packaging, marking, labeling, documentation, stowage, and quantity limitations. It is thus not directly relevant to our discussion of the designation of marine protected areas.

43. Information available at www.imo.org/About/Conventions/StatusOfConventions/Pages/Default.aspx.

44. "Guidelines," supra note 40.

45. N. Oral "Protection of Vulnerable Marine Ecosystems in Areas Beyond National Jurisdiction: Can International Law Meet the Challenge?" in *Unresolved Issues and New Challenges to the Law of the Sea: Time Before and Time After*, edited by A. Strati, M. Gavouneli, and N. Skourtos (Leiden: Nijhoff, 2006), 104.

46. Office of General Counsel, NOAA, "Marine Protected Areas (MPAs): Special Area Designation," available at http://www.gc.noaa.gov/gcil_mpa-sad.html.

47. http://www.imo.org/en/OurWork/Environment/SpecialAreasUnderMARPOL/Pages/Default.aspx.

48. IMO Assembly Resolution A. 982(24), of 1 December 2005, "Revised Guidelines for the Identification and Designation of Particularly Sensitive Sea Areas" (IMO doc. A24/Res.982, of 6 February 2006).

49. Y. Tanaka, *A Dual Approach to Ocean Governance* (Farnham, Surrey: Ashgate, 2008), 176.

50. *Ibid.* and M. J. Kachel, *Particularly Sensitive Sea Areas: The IMO's Role in Protecting Vulnerable Marine Areas* (Berlin: Springer, 2008), 155.

51. PSSA Guidelines, paragraph 4.

52. http://www.imo.org/en/OurWork/Environment/PSSAs/Pages/Default.aspx.

53. United Nations Convention on the Law of the Sea, 10 December 1982, entered

into force 16 November 1994, 1833 *U. N. T. S.* 396.

54. Status of the convention as of 10 October 2014. It must be emphasized that, since its adoption in 1982, it has been the policy of the United States' government to treat most of the provisions of the UNCLOS as a reflection of existing rules of customary international law.

55. R. Lagoni, "Marine Protected Areas in the Exclusive Economic Zone" in *International Maritime Environmental Law: Institutions, Implementation and Innovations*, edited by A. Kirchner (The Hague: Kluwer, 2003), 162. It could however be argued that the IMO's PSSA concept implements article 211(6) of the LOS Convention. Indeed, paragraph 7.5.2.3(iii) of the PSSA Guidelines specifically refers to article 211(6) as a possible legal basis for an associated protective measure, which is a mandatory requirement in the PSSA designation process.

56. Convention on Biological Diversity, 22 May 1992, entered into force 29 December 1993, 1760 *U. N. T. S.* 143.

57. C. de Roo et al., "Background Paper: Environmental Governance in the Marine Arctic" (2008), available at arctic-transform.org/download/EnvGovBP.pdf).

58. D. Rothwell, "Global Environmental Protection Instruments and the Polar Marine Environment" in *Protecting the Polar Marine Environment—Law and Policy for Pollution Prevention*, edited by D. Vidas (Cambridge: University Press, 2007) 57 at 72–73.

59. https://www.cbd.int/countries/profile/default.shtml?country=is. Emphasis added.

60. https://www.cbd.int/countries/profile/default.shtml?country=ru.

61. The CBD Strategic Plan 2011–20 consists of five strategic goals, including twenty Aichi Biodiversity Targets. Target 11 under Strategic Goal C (To improve the status of biodiversity by safeguarding ecosystems, species and genetic diversity) provides: "By 2020, at least 17 per cent of terrestrial and inland water, and *10 percent of coastal and marine areas*, especially areas of particular importance for biodiversity and ecosystem services, are conserved through effectively and equitably managed, ecologically representative and well connected systems of protected areas and other effective area-based conservation measures, and integrated into the wider landscapes and seascapes." https://www.cbd.int/sp/targets/. Emphasis added.

62. https://www.cbd.int/countries/profile/default.shtml?country=no.

63. https://www.cbd.int/countries/profile/default.shtml?country=se.

64. https://www.cbd.int/countries/profile/default.shtml?country=fi.

65. https://www.cbd.int/countries/profile/default.shtml?country=dk.

66. https://www.cbd.int/countries/profile/default.shtml?country=ca.

67. Arctic Environmental Protection Strategy: Canada, Denmark, Finland, Iceland, Norway, Sweden, Union of Soviet Socialist Republics, and United States, 14 January 1991, 30 I. L. M. 1624.
68. Chapter 2.2 (viii) (Principles).
69. https://oaarchive.arctic-council.org/handle/11374/154.
70. http://www.caff.is/expert-groups-series/93-cpan-principles-and-guidelines.
71. UNEP-WCMC, supra note 31, at 103.
72. CAFF Report to SAAO 1997 at 17, available at http://www.caff.is/administrative-series/view_document/140-caff-progress-report-to-senior-arctic-officials-alta-norway-june-1997. See also T. Koivurova, "Governance of protected areas in the Arctic," *Utrecht Law Review* 5 (2009): 44 at 51.
73. The report of this meeting is available at arcticportal.org/uploads/s6/OE/s6OEMf-51jrbs-B83-NTrw/Seventh-Meeting-of-the-CAFF-International-Working-Group-CAFF-VII-Yellowknife-1999-Summary-Report-1999.pdf.
74. Koivurova, supra note 71, 51–52.
75. *CAFF Habitat Conservation Report No. 11—CPAN Country Updates Report* (2004), available at http://library.arcticportal.org/1301/.
76. Koivurova, supra note 71, 52.
77. *Ibid*. 54.
78. Inari Declaration, available at www.arctic-council.org, paragraph 5.
79. PAME, *Arctic Marine Strategic Plan* (2004), available at http:/arcticportal.org/pame/amsp.
80. Koivurova, supra note 71, 55.
81. AMSP, para. 7.3.2.
82. Strategic Action 7.2.10, AMSP 2015–25, supra note 10, 14.
83. PAME, *Arctic Marine Shipping Assessment 2009 Report* (Arctic Council, April 2009), available at http://www.pame.is/index.php/projects/arctic-marine-shipping/amsa/amsa-2009-report.
84. AMAP/CAFF/SDWG, *Identification of Arctic Marine Areas of Heightened Ecological and Cultural Significance: Arctic Marine Shipping Assessment (AMSA) IIc* (Oslo: Arctic Monitoring and Assessment Programme, 2013), available at http://www.amap.no/documents/doc/Identification-of-Arctic-marine-areas-of-heightened-ecological-and-cultural-significance-Arctic-Marine-Shipping-Assessment-AMSA-IIc/869.
85. Preface, *ibid*. The areas of heightened cultural significance are addressed in a separate section of the report (part B) and are not integrated with the

information on areas of heightened ecological significance (part A). The preface further provides that "Part B should be seen as instructive in that it illustrates where additional data collection and integration efforts are required."

86. *Ibid*. Part B describes different types of areas of heightened cultural significance, then provides examples of each in the form of case studies from around the North, and concludes by discussing approaches to protecting such areas in the context of vessel traffic.

87. Executive Summary, *ibid*., 1.

88. *Ibid*.

89. Det Norske Veritas, *Report—Specially Designated Marine Areas in the Arctic High Seas*, 11 March 2014, available at http://www.pame.is/index.php/projects/arctic-marine-shipping/specially-designated-marine-areas-in-the-arctic.

90. http://www.pame.is/index.php/projects/arctic-marine-shipping/amsa/amsa-documents.

91. Executive Summary, supra note 88, 4.

92. *Ibid*.

93. *Ibid*.

94. *Ibid*.

95. Available on the UNEP website at www.unep.org/dewa/giwa/areas/kirkenes.htm.

96. Roo et al., supra note 56, 23–24.

97. See the website of the Working Group on Environment (WGE) at www.beac.st/?DeptID=8555.

98. See the BPAN project website at www.bpan.fi/en/.

99. BPAN Policy Brief, "Recommendations for Strengthening the Protected Area Network in the Barents Region" (5 December 2013), available at http://www.bpan.fi/wp-content/uploads/2013/12/BPAN_PolicyBrief.pdf.

100. *Ibid*.

101. See the European Commission's Natura 2000 website at ec.europa.eu/environment/nature/natura2000/index_en.htm.

102. http://ec.europa.eu/environment/nature/natura2000/barometer/index_en.htm.

103. The two central legal instruments are the 1982 United Nations Law of the Sea Convention, supra note 52, and the United Nations Agreement for the Implementation of Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks, 4 August 1995,

entered into force 11 December 2001, 2167 *U. N. T. S.* 88. All eight Arctic States are parties to the Fish Stocks Agreement.

104. See the IUCN definition of a "protected area," supra note 5.

105. http://www.nafo.int.

106. http://www.nasco.int.

107. http://www.neafc.org.

108. Three agreements between Norway and the former Soviet Union form the basis of the Barents Sea fisheries regime: the Agreement on Co-Operation in the Fishing Industry (Framework Agreement), concluded and entered into force 11 April 1975, 983 *U. N. T. S.* 8; the Agreement Concerning Mutual Relations in the Field of Fisheries (Mutual Access Agreement), concluded and entered into force on 15 October 1976, 1157 *U. N. T. S.* 147 and the Agreement between Norway and the Soviet Union on Provisional Practical Arrangements on Fishing in an Area Adjacent of the Barents Sea (Grey Zone Agreement), concluded and entered into force 11 January 1978, original Norwegian text at [1978] Overenskomster med fremmede stater 436. The 1975 Framework Agreement created the Norwegian-Russian Fisheries Commission, the institutional hub of the regime. In addition to the three core agreements, a set of other agreements between the two coastal states and non-coastal user states forms part of the basis for the Barents Sea fisheries regime. See O. S. Stokke, "The Loophole of the Barents Sea Fisheries Regimes" in *Governing the High Seas Fisheries: The Interplay of Global and Regional Regimes*, edited by O. S. Stokke (Oxford: University Press, 2001) 273 at 274.

109. See the 1988 Agreement between the Government of the United States of America and the Government of the Union of Soviet Socialist Republics on Mutual Fisheries Relations, available at http://www.nmfs.noaa.gov/ia/slider_stories/2013/04/agreement.pdf.

110. Agreement on Cooperation in Research, Conservation and Management of Marine Mammals in the North Atlantic, 9 April 1992, entered into force 8 July 1992, available at http://www.nammco.no/webcronize/images/nammco/659.pdf.

111. http://www.nammco.no.

112. The Canada-Greenland Joint Commission on Beluga and Narwhal was established in 1991 under terms of a memorandum of understanding between the federal Department of Fisheries and Oceans of Canada and the Ministry of Fisheries and Hunting of the Greenland Home Rule Government. For more information, see http://www.nwmb.com/en/home/2-uncategorised/83-canada-greenland-joint-commission-on-beluga-and-narwhal.

113. The table "Existing MPAs" provides the following statistics: Canada has five

MPAs covering 29,892 km^2 of its Arctic EEZ; Denmark/Greenland has five MPAs covering 96,889 km^2 (one MPA accounting for 87,911 km^2); Iceland has twenty MPAs covering 3,421 km^2; Norway has eight MPAs covering 83,410 km^2 (Svalbard West accounting for 20,044 km^2 and Svalbard East accounting for 55,467 km^2); Russia has eleven MPAs covering 100,700 km^2; and the United States has fifteen MPAs covering 472,400 km^2. See PAME, supra note 10.

114. *Scientific Consensus Statement on Ecosystem-based Management* (COMPASS, 2005), available at http://www.compassonline.org (date accessed 19 September 2009).

115. A. T. White et al., *Creating and Managing Marine Protected Areas in the Philippines* (Cebu City, Philippines: Coastal Conservation and Education Foundation, Inc., and University of the Philippines Marine Science Institute, 2005), available at http://sanctuaries.noaa.gov/management/pdfs/js_mentor_networks_mod2_curr.pdf.

116. *Ibid*. Emphasis in the original.

117. T. Koivurova and E. J. Molenaar, “International Governance and Regulation of the Marine Arctic—Overview and Gap Analysis” (Oslo: WWF International Arctic Programme, 2009), 9, available at http://www.wwf.se/source.php/1223579/International%20Governance%20and%20Regulation%20of%20the%20Marine%20Arctic.pdf.

118. A “Strategic Action” in PAME’s recently updated *Arctic Marine Strategic Plan 2015–25*, supra note 10, 14.

119. S. Jennings, “The Role of Marine Protected Areas in Environmental Management,” *ICES Journal of Marine Science* 66 (2009): 16, available at http://www.icesjms.oxfordjournals.org/cgi/content/full/66/1/16.

120. Part II, R. S. C. 1996, c. 31.

121. http://www.dfo-mpo.gc.ca/oceans-habitat/oceans/ri-rs/mpaframework-cadrezpm/page01_e.asp.

122. http://www.dfo-mpo.gc.ca//oceans/publications/fedmpa-zpmfed/pdf/mpa-eng.pdf.

123. http://www.dfo-mpo.gc.ca/oceans/publications/oap-pao/pdf/oap-eng.pdf.

124. http://www.dfo-mpo.gc.ca/oceans/publications/dmpaf-eczpm/framework-cadre2011-eng.asp.

125. The purpose of the Tarium Niryutait MPA is to conserve and protect beluga whales and other marine species (anadromous fish, waterfowl, and seabirds), their habitats, and their supporting ecosystems. The management plan also protects the harvesting traditions central to the Inuvialuit culture in the

communities of Aklavik, Inuvik, and Tuktoyaktuk.

126. See chapter 3 "Marine Protected Areas" in Office of the Auditor General of Canada, *2012 Fall Report of the Commissioner of the Environment and Sustainable Development*, 5 February 2013, available at http://www.oag-bvg.gc.ca/internet/English/parl_cesd_201212_e_37708.html.

127. *Ibid*. Emphasis added.

128. PAME, "Framework for a Pan-Arctic Network of Marine Protected Areas," April 2015, available at https://oaarchive.arctic-council.org/bitstream/handle/11374/417/MPA_final_web.pdf?sequence=1&isAllowed=y : 19.

129. *Ibid*.

130. Jennings, supra, note 118.

131. *Ibid*.

132. *Ibid*.

133. As Côté and Finney explain, Canada's federal marine protected area network comprises three core programs: "(1) marine protected areas, established by Fisheries and Oceans Canada under the *Oceans Act* to protect and conserve important fish and marine mammal habitats, endangered marine species, unique features and areas of high biological productivity or biodiversity; (2) marine wildlife areas, established by Environment Canada to protect and conserve habitat for a variety of wildlife including migratory birds and endangered species; (3) national marine conservation areas, established by Parks Canada to protect and conserve representative examples of Canada's natural and cultural marine heritage and provide opportunities for public education and enjoyment." Côté and Finney, supra note 13, 9.

134. CBD Technical Series No. 19, 'The International Legal Regime of the High Seas and the Seabed Beyond the Limits of National Jurisdiction and Options for Cooperation for the Establishment of Marine Protected Areas (MPAs) in Marine Areas Beyond the Limits of National Jurisdiction," published by the Secretariat of the Convention on Biological Diversity (2005), 29, available at http://www.cbd.int/doc/publications/cbd-ts-19.pdf.

135. *Ibid*.

136. Côté and Finney, supra note 13, 8.

137. *Ibid*.

138. PAME, supra note 7, 3.

139. See the Recommendation of the Ad Hoc Open-ended Informal Working Group to the UN General Assembly on the development of an international instrument under the United Nations Convention on the Law of the Sea for the conservation and sustainable use of marine biological diversity of areas beyond

national jurisdiction. "Recommendation of the 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 to the sixty-ninth session of the General Assembly, 23 January 2015, available at http://www.un.org/depts/los/biodiversityworkinggroup/documents/AHWG_9_recommendations.pdf.

140. Convention for the Protection of the Marine Environment of the North-East Atlantic, 22 September 1992, entered into force 25 March 1998, 2354 U. N. T. S. 67.

141. Convention for the prevention of marine pollution by dumping from ships and aircraft, 15 February 1972, entered into force 7 April 1974, 932 U. N. T. S. 3.

142. Convention for the prevention of marine pollution from land-based sources, 4 June 1974, entered into force 6 May 1978, 1546 U. N. T. S. 103.

143. Roo et al., supra note 56, 23–24.

144. See the interactive map of the North-East Atlantic area covered by the OSPAR regime and its different sectors, including the Arctic Waters (OSPAR Region I), at http://www.ospar.org/convention/the-north-east-atlantic.

145. Roo et al., supra note 56, 26.

146. Section "H" of the Rules of Procedure of the OSPAR Commission (available at www.ospar.org) sets out the voting procedures. It should be noted, however, that OSPAR's Executive Secretary emphasizes that OSPAR works "collaboratively and by consensus, with a work programme driven and delivered by its Contracting Parties." See OSPAR Commission, "Introduction from the Executive Secretary," available at http://www.ospar.org/about/introduction. Emphasis added.

147. Denmark, Finland, Iceland, Norway, and Sweden are all parties to the OSPAR Convention. Finland, of course, has no coastal frontage on the North-East Atlantic but it is a member of the commission because some of its rivers flow to the Barents Sea and it has historically been involved in the efforts to control the dumping of hazardous waste in the Atlantic and the North Sea. The other parties to the convention are Belgium, the European Union, France, Germany, Luxemburg, the Netherlands, Portugal, Spain, Switzerland, and the United Kingdom.

148. OSPAR Commission, "Introduction from the Executive Secretary," available at http://www.ospar.org/about/introduction.

149. K. Hübner and M. Hauswirth, *2014 Status Report on the OSPAR Network of Marine Protected Areas* (2015), available at http://www.ospar.org/documents?v=33572 : 7.

150. *Ibid*.

151. *Ibid.*

152. *Ibid.*

153. Available at http://mpa.ospar.org/home_ospar/keyfigures.

154. Hübner, supra note 148, 10.

155. *Ibid.*, 16.

156. *Ibid.*, 15–16. According to the executive summary of the 2014 status report, in 2014, seventy-seven MPAs covering more than 89,397 km^2 were added to the OSPAR network of MPAs, representing an increase in area coverage by 0.65 percent since 2013.

157. Ibid., 18.

158. See the map of areas beyond national jurisdiction, figure I in annex III, *ibid.*, 59.

159. *Ibid.*, 18.

160. The proposals to designate OSPAR MPAs in ABNJ were elaborated on the basis of data and information collated within the framework of international research programs in the Northeast Atlantic. "These proposals were originally prepared by WWF [. . .] and the University of York, subsequently reviewed by the International Council for the Exploration of the Sea (ICES) in 2008 . . . and gradually finalized by the relevant OSPAR bodies, namely the Intersessional Correspondence Group on Marine Protected Areas (ICG-MPA), the Working Group on Marine Protected Areas, Species and Habitat (MASH) and the Biodiversity Committee (BDC)." Ibid., 60.

161. See the explanations in footnotes 13–15, *ibid.*, 10.

162. *Ibid.*, 19.

163. *Ibid.*

164. *Ibid.*, 21.

165. *Ibid.*

166. *Ibid.*, 18.

167. *Ibid.*

168. E. J. Molenaar and A. G. Oude Elferink, "Marine Protected Areas in Areas Beyond National Jurisdiction: The Pioneering Efforts Under the OSPAR Convention" *Utrecht Law Review* 5: 1 (2009): 5 at 14. Footnotes omitted.

169. A. Chircop et al., "Governance of Marine Protected Areas in East Africa: A Comparative Study of Mozambique, South Africa and Tanzania" *Ocean Development and International Law* 41 (2010): 1.

170. *Ibid.*, 2–3.

171. *Ibid*., 3.

172. See e.g., J. B. Bellinger, "Treaty of Ice" (23 June 2008), *The New York Times* at www.nytimes.com/2008/06/23/opinion/23bellinger.html?_r=0.

173. Chircop et al., supra note 168, 17.

174. *Ibid*., 21.

175. PAME, *Framework for a Pan-Arctic Network of MPAs* (Arctic Council, April 2015), available at http://www.pame.is/images/03_Projects/MPA/MPA_Report.pdf : 17.

176. Chircop et al., supra note 168, 9.

177. See the Arctic Council website at http://www.arctic-council.org/index.php/en/about-us/arctic-council/observers.

178. Agreement on Cooperation in Aeronautical and Maritime Search and Rescue in the Arctic, 12 May 2011, available at www.arctic-council.org.

179. CPAN Strategy and Action Plan, supra note 68, 12.

180. CPAN Principles and Guidelines, supra note 69, 5.

Commentary

David L. VanderZwaag

Lalonde's paper offers a critical and rather sobering look at the protection of ecologically and culturally significant marine areas as a major element of ocean stewardship in the Arctic. She documents the meager designation of Ramsar wetlands, World Heritage sites, and Man and the Biosphere reserves in the Arctic. She demonstrates how the protection of marine areas by Arctic states has substantially lagged behind terrestrial measures. The paper notes the lack of success, to date, in establishing a regional network of marine protected areas (MPAs), even though such a network has been on the Arctic Council's agenda since 1996.

My commentary seeks to add further details and thoughts to Lalonde's coverage in six areas. They are: addressing the conservation of transboundary waterbirds, following through with the identification and protection of ecologically and culturally significant areas from adverse shipping impacts, establishing a network of Arctic MPAs, sorting out future directions for governance of the central Arctic Ocean beyond national jurisdiction, rethinking toxic chemicals management, and facing the implementation challenges of the Minamata Convention on Mercury. The commentary, together with Lalonde's paper, shows that stewardship efforts to protect the Arctic Ocean might be described aptly as quite "sluggish" in light of the huge changes and pressures facing the region.

SIX ADDITIONAL REFLECTIONS

Addressing the Conservation of Transboundary Waterbirds

One of the most complicated and unmet challenges in Arctic-related governance is the conservation of highly migratory waterbirds. The Arctic hosts for part of the year more than half of the world's shorebird species and some 80 percent of the global goose populations (CAFF 2010, 8). At least 279 species of birds, arriving in the region from such distant areas as South Africa, Australia, New Zealand, and South America, take advantage of the highly productive summer breeding seasons (CAFF 2010, 8). Five major flyways extending into the Arctic have been identified for migrating shorebirds (UNEP/CMS Secretariat 2014, 13). Over thirty international flyway-based instruments have been forged for the conservation of migratory birds (UNEP/CMS Secretariat 2014, 11).

A promising project, initiated during Canada's chairmanship of the Arctic Council (2013–15) is the Arctic Migratory Birds Initiative (AMBI) being carried out by the Arctic Council's Working Group on Conservation of Arctic Flora and Fauna (CAFF). The AMBI, through a series of workshops, has identified three main conservation issues facing Arctic migratory birds, namely, habitat loss and degradation, especially in international areas; unsustainable harvesting; and marine bycatch (CAFF 2014). An Arctic Migratory Birds Initiative Workplan has been developed for 2015–19 (CAFF 2015) which identifies priority species for conservation efforts in four main flyways of the world and suggests key actions to improve the conservation status of declining bird populations. For the East Asian-Australasian Flyway, priority species include the bar-tailed godwit, great knot, red knot, dunlin, spoon-billed sandpiper, and the lesser white-fronted goose (CAFF 2015, 14). African-Eurasian Flyway priority species include the black-tailed godwit, bar-tailed godwit, lesser white-fronted goose, dunlin, and red knot (CAFF 2015, 14). The Americas Flyway priorities include the red knot and semipalmated sandpiper (CAFF 2015, 15). The Circumpolar Flyway includes six priority species: ivory gull, thick-billed murre, Steller's eider, common eider, long-tailed duck, and the snowy owl (CAFF 2015, 15).

The AMBI Workplan for the East Asian-Australasian Flyway should be of particular interest to the North Pacific Arctic Conference as it proposes numerous actions to help conserve migratory waterbird species that range from Arctic areas in Russia and Alaska, southwards through East and Southeast Asia, and to Australia and New Zealand (CAFF 2015, 16). For example, China is encouraged to ensure the protection of various coastal ecosystems important to Arctic shorebirds, such as along the Jiangsu and Luannan coasts (CAFF 2015, 20–21). Conservation efforts are encouraged for the intertidal areas on the west coast of the Republic of Korea, including the designation of key habitats for protection and the support of coastal-wetland restoration schemes (CAFF 2015, 21). In cooperation with Singapore, the workplan calls for exploring the possibility of forming an Association of Southeast Asian Nations (ASEAN) plus network of migratory bird sites and the possible organization in Singapore in 2016–17 of an international conference/workshop on migratory bird conservation (CAFF 2015, 23). All countries are urged to coordinate their actions to conserve intertidal habitats within the flyway and to support the securing of more resources for operating the East Asian-Australasian Flyway Partnership based in the Republic of Korea (CAFF 2015, 21).

Three questions stand out in relation to AMBI that might be addressed in North Pacific Arctic Conference discussions. To what extent have Asian observer states to the Arctic Council already been involved in the Arctic Migratory Birds Initiative? What future involvements might be considered? Should a formal treaty framework be developed to further promote conservation cooperation in the East Asian-Australasian Flyway, perhaps based on the model of the African-Eurasian Waterbirds Agreement?

Protecting Ecologically and Culturally Significant Areas from Adverse Shipping Impacts

Vessel-routing measures in Arctic waters to protect the marine environment from potential adverse impacts of shipping are still limited. Vessel-traffic routing arrangements, approved by the International Maritime Organization (IMO), exist for Prince William Sound in Alaska and for some coastal waters off Iceland (IMO 2008). The US Coast Guard has undertaken public consultations on proposed routing measures in the Bering Strait region (Miller 2015).

Only two IMO approved vessel-routing schemes have been established specifically aimed at protecting sensitive Arctic ecosystems. Effective on 1 July 2007, Norway established a series of traffic-separation schemes and recommended routes off its northern coast and in the Barents Sea (IMO 2006). Tankers of all sizes and other cargo ships of 5,000 gross tonnage and above engaged in international voyages are encouraged to navigate about thirty nautical miles from land.

At its ninety-fifth session in June 2015, the Maritime Safety Committee (MSC) approved five areas to be avoided in the region of the Aleutian Islands off Alaska (MSC 2015, 50). The routing measures, effective on 1 January 2016, will be applicable to ships of 400 gross tonnage and above on international voyages and will aim to provide about fifty-nautical-mile buffer zones around the islands.

Canada, in particular, exemplifies the limited follow through on vessel-navigational measures. Canada presently has no specific mandatory routing requirements for the Arctic. Some recommended navigational suggestions exist, such as advising ships to stay at least ten miles away from shore on the north and south coasts of Lancaster Sound in order to avoid the fall migration of marine mammals (Fisheries and Oceans Canada 1999). Few marine areas are closed to shipping activities. The entry of cruise ships is prohibited for most fiords in two national parks in the Arctic, Quttinirpaaq National Park (Ellesmere Island) and Auyuittuq National Park (Baffin Island) (Canadian Coast Guard 2015). In Canada's only Arctic marine protected area under the Oceans Act, Tarium Niryutait (which includes three coastal areas in the Beaufort Sea), MPA regulations (SOR/2010-190) restrict the types of shipping activities allowed. Categories of permitted shipping include: fishing, scientific research, some oil and gas activities, and governmental vessels involved in law enforcement, exercise of Canadian sovereignty, or emergency response. Annual "Notices to Mariners" provide general guidelines for addressing shipping impacts on marine mammals. For example, ships are advised to reduce speed below seven knots when within 400 meters (m) of the nearest marine mammal, avoid approaching whales from the front or from behind, and to turn on an echo sounder to signal the ship's presence (Canadian Coast Guard 2015).

A potential issue on the horizon is whether Canada would seek IMO approval for future routing measures in Arctic waters. Canada could rely on article 234 of the Law of the Sea Convention to justify unilateral measures where waters are ice-covered for most of the year; Canada might also justify measures based on internal-waters status. Considerable uncertainty exists over the interpretation of article 234 and the extent to which the article justifies unilateral reporting or routing measures by a coastal state (McDorman 2014).

Establishing a Network of MPAs

Lalonde's overall conclusion that the establishment of an MPA network in the Arctic will be slow and challenging is further supported by the "politically cautious" commitments found in Working Group on the Protection of the Arctic Marine Environment's Framework for a Pan-Arctic Network of Marine Protected Areas (PAME 2015a). Approved at the Ninth Ministerial Meeting of the Arctic Council in April 2015, the document sets no overall regional target for the designation of coastal and marine protected areas. The framework emphasizes its nonbinding nature and suggests that each Arctic state is to pursue MPA development based on its own priorities and timelines (PAME 2015a, 5). How the framework will be implemented remains vague with a general call for the Protection of the Arctic Marine Environment (PAME)-led MPA expert group to become an expanded forum where Arctic nation's implementing agencies can share plans and best practices (PAME 2015a, 21). The engagement of stakeholders and options for MPA-network financing are identified as further short-term action items (PAME 2015, 21). The framework's conclusion highlights the broad discretion left to states in choosing whether to expand their MPA systems: "Arctic States may choose to identify additional MPAs to strengthen the biodiversity and ecological resilience of the circumpolar Arctic" (PAME 2015a, 22).

PAME's workplan for 2015–17 does include a few initial steps forward. Three MPA-related projects are proposed: an updated mapping of existing Arctic MPAs (PAME 2015b, annex IV); a desktop study on area-based conservation measures in the Arctic (PAME 2015b, annex V); and a narrative report on existing mechanisms for engaging indigenous peoples and local communities in Arctic marine activities (PAME 2015b, annex III).

Sorting out Future Directions for Governance of the Central Arctic Ocean

A major step forward in addressing high seas governance in the Central Arctic Ocean (CAO) occurred in Oslo, Norway on 16 July 2015 when representatives of the five Arctic Ocean coastal states adopted a Declaration Concerning the Prevention of Unregulated High Seas Fishing in the Central Arctic Ocean. The declaration pledges the establishment of a joint-scientific research program to improve ecosystem understandings in the area. The declaration promises the coordination of monitoring, control, and surveillance activities in the high seas area. The five coastal states agree that they will not authorize commercial fishing by their vessels in the area unless pursuant to one or more regional or subregional fisheries management organizations or arrangements that are or may be established to manage such fishing.

The declaration leaves various issues to be sorted out. How Arctic residents and indigenous peoples will be engaged in implementing the interim measures is left unclear. The declaration expresses an intent to encourage other states to take measures for their flagged vessels consistent with the adopted interim measure, but how the consistency is to be achieved is left open. Among possible ways forward would be promotion of a broader political declaration involving other interested states, incorporation of interim measures in a United Nations General Assembly resolution on sustainable fisheries, and negotiation of a new legally binding agreement on conservation and the sustainable use of biodiversity in the CAO.

David Balton, present chair of Senior Arctic Officials and deputy assistant secretary for Oceans and Fisheries, US Department of State, did provide further guidance at a talk given at the Conference on Global Leadership in the Arctic: Cooperation, Innovation, Engagement and Resilience (GLACIER) in Anchorage, Alaska, in late August 2015. He announced that the United States would convene an initial December 2015 meeting in Washington, DC, of representatives from the five Arctic coastal states plus representatives from China, Japan, the Republic of Korea, Iceland, and the European Union to discuss the development of a binding agreement to prevent unregulated commercial fishing in the CAO.

As noted in Lalonde's paper, Arctic states have yet to agree on whether, and if so, how to pursue protection of the Arctic high seas through IMO. At PAME's meeting in September 2014, member governments decided to take a number of interim steps before pursuing actions within the IMO, including the preparation of a paper exploring whether dynamic areas to be avoided could be established through the IMO and a paper investigating the possibility for IMO to designate a PSSA located exclusively on the high seas. Those papers have yet to be written. At its February 2015 meeting, PAME invited AMAP and CAFF to denote areas within the high seas area of the CAO particularly vulnerable to international shipping activities, but the AMAP/CAFF report was still not available for review at PAME's September 2015 meeting.

Rethinking Toxic Chemicals Management

The glacially slow process of adding chemicals for control under the Stockholm Convention on Persistent Organic Pollutants (POPs), adopted in 2001, raises the need to rethink approaches to managing toxic chemicals. With three additional POPs (polychlorinated napthalenes, hexachlorobutadiene, and pentachlorophenol and its salts/esters) added to the Stockholm listing at the Seventh Conference of the Parties in May

2015 (UNEP 2015a, annex), a total of only twenty-six chemicals are subject to elimination or restriction. Meanwhile, AMAP's *Arctic Pollution 2009 Report* warned that sixty-five high-production volume (>1000 tons/year) industrial chemicals may have the ability to biomagnify in Arctic traditional food supplies (AMAP 2009, 22). The report also noted that 4300 chemicals, most with low or unknown production, have Arctic-accumulation properties (AMAP 2009, 22). Over 140,000 chemicals are estimated to be on the market with an average of about 700 new chemicals thought to be introduced into commerce each year (UNEP 2013, 10).

More precautionary approaches to the management of POPs and other toxic chemicals need to be considered with two main avenues standing out. States might individually or on a regional basis follow the example of the European Union's REACH (Registration, Evaluation and Authorization of Chemicals) regulation, whereby chemical producers would be required to provide toxicity and safety data for chemicals within a set timeframe (Heyen 2013). If such data were not provided, a marketing prohibition would follow (Mason and VanderZwaag 2015). Negotiating a more comprehensive chemicals convention might be a second way forward. Under a new global convention, a global "reverse-listing" approach might be introduced whereby only new chemicals included on a "safe list" would be allowed to be produced and marketed (VanderZwaag 2011, 627).

Various human rights relating to health and the environment lend normative support for taking more proactive management approaches (Mason and VanderZwaag 2015). For example, article 12 of the International Covenant on Economic, Social and Cultural Rights recognizes the right to the "highest attainable standard of physical and mental health." The United Nations Declaration on the Rights of indigenous Peoples (2007) sets out the right of indigenous peoples "to be secure in the enjoyment of their own means of subsistence" (art. 20[1]) and "the right to the conservation and protection of the environment and the productive capacity of their lands or territories and resources" (art. 29[1]).

The prospects for stronger precautionary approaches do not look bright, at least in the near-term. Getting full ratification and effective implementation of even the existing international toxic-chemical agreements and arrangements continues to be problematic (Mason and VanderZwaag 2015). No political champion or vocal epistemic community has raised the profile of the need for rethinking. The Arctic Council's *The Arctic Ocean Review Project: Final Report (Phase II 2011–2013)* simply emphasized the need to identify new chemicals for international control and to have all Arctic states ratify the Stockholm Convention and UNECE POPs Protocol (PAME 2013, 74).

However, two "seeds of hope" have been planted. UNEP's 2013 Global Chemicals Outlook publication does suggest the need to consider a more ambitious global framework for chemicals management and the possibility of reopening discussion for a new global Sustainable Chemicals Convention (UNEP 2013, 230). The Strategic Approach to International Chemicals Management (SAICM), a voluntary global initiative launched in 2006 to promote better chemicals management (UNEP 2006), calls for considering the further development of international agreements related to chemicals as one of over 250 activities suggested in its Global Plan of Action (UNEP 2006, 83). However, no action on that item appears to have occurred to date relating to toxic chemicals.

Facing Minamata Convention Implementation Challenges

While the Minamata Convention on Mercury, adopted in October 2013, offers numerous positive steps in addressing emissions and releases of mercury into the environment (Eriksen and Perrez 2014), the convention also raises four key implementation challenges beyond the need for 50 ratifications for entry into force and generous implementation timelines, such as a 15 year phase-out for primary mercury mining.

- *Achieving Reductions of Mercury Emissions*—While the convention lists five point sources for which air-emission controls are required (coal-fired plants, coal-fired industrial boilers, nonferrous-metals production, waste-incinerator facilities, and cement-production facilities), the extent to which reductions will be achieved remains to be seen. For new sources, the convention will require the application of best available techniques (BAT) and best environmental practices (BEP), but guidance on BAT and BEP is left to be adopted at the first meeting of the conference of the parties (art. 7.7[a]). Emission reduction is only required "when feasible" (art. 8.4). For existing sources, each party is required to take at least one control measure, but a party is granted broad discretion to limit its measures because of economic and technical feasibility (art. 8.5). The convention excludes some point sources of mercury air emissions. Oil, gas, and iron and steel facilities are not covered by the convention.

- *Ensuring Adequate Financing*—How substantial financing available to support developing countries and economies in transition in meeting mercury control commitments remains to be seen. While the convention mandates the establishment of a two-pronged financial mechanism, a Global Environment Facility Trust Fund and a specific international program to support capacity-building and technical assistance (art. 13.6), funding is to be on a voluntary basis. At the sixth session of the Intergovernmental Negotiating Committee in November 2014, states agreed to establish an ad hoc working group of experts on financing to address financial options further (UNEP 2015b, 13–14).
- *Ensuring Implementation and Compliance*—The convention is quite limited in addressing matters of implementation and compliance. Each party is given discretion as to whether a national implementation plan will be developed and whether such a plan will be transmitted to the secretariat (art. 20). Reporting on implementation measures will be required but details on timing and formats for reporting is left to be decided at the first meeting of the conference of parties (art. 21). An Implementation and Compliance Committee is to be established but it will have limited review powers, for example, without a nongovernmental organization (NGO) review petition option, and will only be facilitative in nature (art. 15).
- *Sorting Out Relationships with Other International Conventions and Initiatives*—Numerous coordination issues stand out. Whether the secretariat for the Minamata Convention should be merged with the joint secretariat forged for the Stockholm Convention, the Basel Convention on Transboundary Movement of Hazardous Wastes and the Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade is an open question. How far standards and guidelines for mercury emission controls under the Aarhus Heavy Metals Protocol will be incorporated under the Minamata Convention is also unclear. Parties to the protocol have already developed a guidance document on best available techniques (UNECE 2013) and a limit value for mercury emissions from waste incineration of 0.05 mg/m3. How a new UNEP international financing scheme, agreed to in June 2014, to support institutional strengthening at the national level to enhance

implementation of the chemicals and waste conventions, including the Minamata Convention, will relate to the mercury convention's specific international financing program to support capacity-building and technical assistance has yet to be resolved (VanderZwaag 2015).

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Commentary

Hugi Ólafsson

The ocean is sometimes referred to as the "last frontier" for humankind on Earth. But it is only a "frontier" in terms of our still-limited knowledge of it. Our impact on the ocean is great and growing. We have had immense effect on marine ecosystems through fishing, pollution, and other pressures, even if it is not as visible as our imprint on the terrestrial systems. This is true even of the Arctic Ocean, sealed below a frozen lid since long before homo sapiens arrived and far removed from centers of industrial activity and pollution. In the last decades, we have become aware that the Arctic is not immune from pollution from distant sources. Even the frozen lid is coming off, with sea ice retreating rapidly; the Arctic Ocean will likely be ice free in summer before mid-century. Few places on the planet are undergoing such profound changes in the physical environment. Responsible stewardship for the Arctic Ocean is an urgent and important task.

Lalonde gives an excellent and thorough description of efforts to curb pollution and protect biodiversity, worldwide and in the Arctic. She also outlines different ideas on the way forward to enhance protection of the Arctic Ocean, ranging from a new regional treaty to more stepwise approaches. She effectively presents us with a full menu of options and also makes some suggestions on which ones we might choose.

FIGHTING POLLUTION: AN ARCTIC SUCCESS STORY

In many ways, the fight against ocean pollution is a success story, worldwide and in the Arctic. Only a few decades ago the oceans were seen by many as a limitless dumping ground for all our refuse, ranging from sludge to radioactive wastes. The London Convention of 1972 prohibited marine dumping, putting an end to that horrendous practice. The decades since have seen a steady trend toward new instruments and improved regulations to curb most types of marine pollution. The fight is far from over, but concentrations of many persistent organic pollutants, heavy metals, etc. seem to be stabilized or slowly declining, allowing for some optimism that organized international efforts can work. Most pollution originates from sources outside the Arctic, but Arctic countries also have been cleaning up in their backyard, including by removing substantial amounts of obsolete pesticides from unsafe storage sites in the Russian Arctic under an Arctic Council (AC) program.

The Arctic is in many ways a star performer in this story. Scientists working in the Arctic sounded an alarm that pollutants were affecting animals and even human health at an alarming level in the Far North. The Arctic Council and Arctic inhabitants, not least the organizations of indigenous peoples, pushed for action and succeeded. The Stockholm Convention on Persistent Organic Pollutants (POPs) and other instruments were put in place not just out of special concern about the Arctic and its inhabitants, but due in part to the fact that pollutants released thousands of kilometers to the south were impacting the Arctic showed how dangerous they were, confirming the need for a global solution. The story of the fight against pollution in the Arctic is inspiring and deserves to be studied and told. Can it be emulated in other areas?

PROTECTING BIODIVERSITY IN ARCTIC SEAS

Protecting marine biodiversity is in many ways a more complex task than curbing pollution. There are two main approaches to this challenge: regulating human activities that affect the ecosystem and defining areas for marine life that serve as sanctuaries or offer some kind of protection. Establishing marine protected areas (MPAs) is a particularly active field at present, and it is on this effort that Lalonde's paper focuses. There are different categories of protective areas, but in the Arctic countries it is clear that "efforts in regard to protecting marine areas lag behind terrestrial measures" and that "Arctic marine protected areas appear to be severely underrepresented." Efforts by the Arctic Council seem to have gathered little steam: The work of the Working Group on the Conservation of Arctic Flora and Fauna (CAFF) on a network of protected areas "became dormant," with the group focusing on monitoring and assessing Arctic biodiversity instead.

A new effort is now under way, this time under the Working Group on the Protection of the Arctic Marine Environment (PAME), which aims to build a network of MPAs in the Arctic. A "Framework for a Pan-Arctic Network of Marine Protected Areas" was adopted at the Iqaluit Ministerial in April 2015, and next steps in developing this framework are outlined in that document and in PAME's work plan for 2015–17. Will this effort succeed in pushing the establishment of MPAs in the Arctic?

There is reason for cautious optimism on that score. As Lalonde points out, the process of establishing MPAs in Canada can be long and tortuous. The situation is hardly different in other countries and some, such as Iceland and Greenland, have simply not put great emphasis on MPAs in their marine policies. Thus the question: "If such difficulties are encountered at the national level in trying to define what should be the objectives of MPAs and what form they should take . . . how are different visions to be reconciled at the circumpolar level?"

The short answer is: gradually and by employing great sensitivity. A helpful basis for a sensible approach to this task is to look at different forms of networks cited Lalonde's paper: social, ecological, and management-based networks. Before we achieve a well-managed ecologically coherent network of MPAs in Arctic seas, we must develop a network of experts who work in this field and who can share experience, identify good practices, and get a feel for different viewpoints. The eight Arctic countries have different approaches to MPAs. Permanent Participants in the Arctic Council also want to have a say in the MPAs discussion, and some are apprehensive, perhaps suspecting that the push for MPAs masks a heavily conservationist agenda that could clash with policies emphasizing sustainable use and traditional utilization of marine resources. The designation of MPAs is also a sovereign decision. "Each Arctic State pursues MPA development based on its own authorities, priorities and timelines," PAME points out. In waters outside national jurisdiction, myriad legal and political questions arise. Without a sensible blueprint, this new initiative might grind to a halt like previous ones.

Luckily, some groundwork has already been done. Much analysis has been done at the national, pan-Arctic, and international levels to identify biologically rich and sensitive areas in the Arctic and also criteria for establishing MPAs. Other types of area-based conservation efforts also have been studied, including particularly sensitive sea areas (PSSAs) and other related measures under IMO in connection with shipping routes. By now, a forum of MPA experts has been established under PAME with a ministerial mandate to chart a future direction for the MPA work. This work can be useful not only for the Arctic but may also support global deliberations on MPAs.

It should be stated clearly that MPAs are not the only tool for protecting biodiversity. They can even provide false comfort if they are not part of a wider strategy. The success (and failure so far) of MPAs is often measured against a global target of 10 percent coverage agreed upon at the Johannesburg World Summit on Sustainable Development in 2002 and by the Convention on Biological Diversity (CBD). But if MPA designations maximizing the area cover rather than effectiveness, you risk getting large "desktop MPAs" with little conservation value.

This danger is recognized in the paper, with the example of an extensive MPA around the Galapagos Islands providing limited protection in reality. Still, pointing at the limitations of MPAs with striking examples does not mean that they are not important. It just means that an effective biodiversity protection policy needs to look at the big picture. For this, it is helpful to develop criteria and indicators for healthy oceans and ecosystems and good monitoring and assessment programs. In addition, you need a toolbox of possible protective measures to respond to threats and maintain good status. MPAs are one instrument in the toolbox, but not the only one. They need to be guided by science and a clear purpose and not only seek to maximize area coverage.

A REGIONAL MARINE CONVENTION FOR THE ARCTIC OCEAN?

The last part of the paper cites several governance models that have been put forward for the Arctic in order to focus minds on where we could go in the future. The options range from establishing a formal treaty to a more piecemeal approach, using soft law and informal instruments to reach different goals. The paper does a commendable job in collecting and presenting these options.

Lalonde believes that a "framework regional seas action plan or convention offers the best combination of flexibility and effectivity and that the OSPAR (original Oslo and Paris Conventions …) regime may offer an interesting and plausible model." One of the merits of OSPAR is that it provides the "best example of a comprehensive, effectively managed and ecologically representative regional system of MPAs." This suggestion merits serious consideration. It should help that five of the eight Arctic states are members of the OSPAR commission and the OSPAR region already covers a slice of the Arctic; one of the five OSPAR regions is called "Arctic Waters." So, do we have here a blueprint that we can emulate for the Arctic as a whole?

Before answering that question, some might want to point out that so far there have been few signs of a strong will among Arctic states to start negotiating a legal convention on the Arctic Ocean (or Arctic seas, depending on which terminology you want to use and what areas you want to cover). The current Arctic Council model of cooperation, with an AC-wide Arctic Marine Strategic Plan (AMSP), and various marine projects in the field of oceans policy (PAME), pollution control and prevention (EPPR and ACAP), and scientific monitoring and assessment (AMAP and CAFF), has seemed to suit most countries well. In drafting the *The Arctic Ocean Review Project 2009–2013: Final Report 2011–2013* and the updated AMSP for the next decade (2015), no one suggested that a regional marine treaty should be negotiated.

But this question is being put on the agenda by the United States now with a call to examine a "regional seas program" for the Arctic. Such a program does not have to take the legal form of a treaty, but it certainly signals a will to upgrade the current arrangement. So let us restate the question a bit instead of brushing it aside as impractical: Is OSPAR a "plausible and persuasive model" for Arctic oceans governance, even if we tone down the legal form of a convention a bit?

OSPAR has succeeded in agreeing on great reductions in marine pollution, and the pollution part of OSPAR's work now is relatively harmonious. OSPAR's work on biodiversity has, however, had some teething problems. There is sometimes a rift between European Union member states and the few non-European Union members of the regime. There are also differences between countries with claims to the continental shelf and those with a fairly small marine economic zone. The former, for example, are reluctant to establish MPAs outside exclusive economic zones if it affects their claims over the extended continental shelf. Countries highly dependent on fisheries find themselves at odds with other countries that often work closely with environmental protection groups. Fishing nations suspect that a biodiversity agenda might be used for taking up fisheries-management issues, officially outside OSPAR's remit.

MPAs in the OSPAR network are mostly set up by the member states themselves and they have different approaches and coverage regarding MPAs. There is surely an appetite on the part of some OSPAR countries to have a more centralized approach with OSPAR bodies pointing out gaps in MPA coverage and effectiveness and pushing countries to close those gaps. For other countries this is unacceptable, akin to having an international body deciding upon the location of their national parks and other protected areas on land.

The eight states of the Arctic Council are in some ways a more diverse group than OSPAR members, most of which are European Union members. Not everyone would be comfortable with an intergovernmental authority deciding upon the location and operation of MPAs in the Arctic. But, luckily, such an approach is not needed for successful initiatives regarding MPAs. Building an MPA network is a task of consensus building. The current workplan on MPAs exerts pressure on states and other actors to clarify their vision and policies and to engage in a dialogue within a specific timeframe. There is no guarantee that this approach will succeed, but there is no other way forward in a body made up of sovereign states working on the basis of consensus.

So, the OSPAR model deserves careful study, even though the Arctic may not be ready for such an approach. Young's words from a 2000 paper are probably still most relevant: "But it would surely be a mistake to allow efforts to solve Arctic problems on a piecemeal basis to be crippled by the dictates of a grand but generally unrealistic vision of a comprehensive, region-wide governance system for the circumpolar world."

CONCLUDING REMARKS

The US chairmanship of the Arctic Council has signaled a wish to push cooperation on marine issues further. Examining a "regional seas program" for the Arctic Ocean in a new ad hoc group may lead us to look with fresh eyes at the possibility of establishing a regional marine convention for the Arctic or establish some other kind of authority that the current regime lacks.

One factor to consider is that the Arctic eight can hardly decide the fate of the Arctic Ocean by themselves. The greatest threats to the Arctic marine environment are largely outside their control. Climate change and carbon emissions are probably the biggest threat for Arctic marine ecosystems, having surpassed pollution and stresses from fisheries, shipping, offshore oil and gas, and other activities.

Warming will gradually remove the sea ice that defines the Arctic Ocean and its ecosystems until it disappears in summer sometime during this century. Acidification may cause an even more profound change in the ecosystem as it provides an existential threat to many animals, including mollusks, corals, and pteropods (tiny swimming snails identified as a "keystone species" in polar food webs). It could be argued that the Paris Agreement adopted in December 2015 is much more important for the Arctic seas than anything the Arctic countries can do by themselves.

Still, a "regional seas program" of some kind could help in making progress on issues that are within the remit of the Arctic countries themselves. Success will need patience, diplomacy, and persistent leadership. The US chairmanship has shown leadership by putting a "regional seas program" for the Arctic on the agenda. This will help all Arctic states and other relevant actors to focus on their vision and responsibility for an ocean that is undergoing dramatic change. Whether or not a new convention is feasible, the changing Arctic needs urgent attention and responsible planning. A systematic study of Lalonde's paper, with her careful analysis of the main issues of marine conservation and clear presentation of different approaches to strengthening Arctic cooperation in this field, would serve those who work in this field well.

Commentary

Elizabeth (Lisa) Speer

THE OPPORTUNITY

Sea ice underpins the ecological superstructure of the Arctic marine environment. Many species, from the tiniest plankton to large mammals (including walrus, narwhal, and bowhead whales) reside or feed on, in, or under the ice, their life cycles exquisitely timed to its seasonal ebb and flow. The loss of summer sea ice is taking with it the future of these animals and the people who depend on them for sustenance and cultural survival.

Disappearing sea ice is also opening up previously inaccessible areas to oil and gas extraction, shipping, fishing, and other human activities. Accidents, oil spills, pollution, invasive species, overfishing, bottom trawling, underwater noise, and a host of other activities and impacts related to industrial development pose significant additional threats to a region already under severe stress from global warming and ocean acidification.

A shrinking window exists to establish a robust system of marine management that can protect key habitats and integrate the assessment and management of multiple human activities that are increasingly impacting this pristine and vulnerable area.

As Lalonde's paper points out, marine protected areas—sanctuaries for ocean wildlife—are an important tool in maintaining the biodiversity and resilience of Arctic marine ecosystems facing profound changes. Only a tiny fraction of the Arctic marine environment has been protected to date (in contrast, roughly 8 percent of the Arctic terrestrial environment enjoys some level of recognition and protection).

Because many species of whales, fish, birds, seals, and other Arctic marine wildlife are highly migratory, it is not enough to pursue marine protected areas (MPAs) independently on a country-by-country basis. Coordinated international action is needed to ensure that the full spectrum of key habitats for different species is protected.

In recognition of the need for such coordination, an expert group was convened under the auspices of the Arctic Council's Working Group on the Protection of the Marine Environment (PAME) in 2013 to evaluate and develop recommendations regarding a pan-Arctic network of MPAs. The expert group's report[1] lays out the following vision for a pan-Arctic network:

> *An ecologically connected, representative and effectively managed network of protected and specially managed areas that protects and promotes the resilience of the biological diversity, ecological processes and cultural heritage of the Arctic marine environment, and the social and economic benefits they provide to present and future generations.*

The report sets forth a variety of recommendations to promote the establishment of an ecologically connected, representative system of MPAs in the Arctic and urges that this work be undertaken as a matter of urgency. The expert group's report was approved by the Arctic Council's Ministerial Meeting in May 2015, signaling council-wide support for moving ahead.

Simultaneous with the approval of the report of the MPA expert group, the United States assumed the chairmanship of the Arctic Council. US Secretary of State John Kerry laid out an ambitious agenda for the US chairmanship, including promoting development of a network of MPAs in the Arctic Ocean. Thus, the time appears to be ripe to move forward.

Many obstacles stand in the way of achieving the vision of an ecologically connected, representative network of Arctic MPAs, as Lalonde has noted. On the other hand, a great deal of groundwork has been laid at the scientific and political levels. With respect to science, a series of efforts at the national and international levels to identify important ecological areas in the Arctic marine environment have yielded sufficiently robust information to start establishing a network of protected areas. These include the International Union for Conservation of Nature and Natural Resources-Natural Resources Defense Council (IUCN-NRDC) 2010 scientific workshop to identify ecologically and biologically important areas (EBSAs) in the marine Arctic, the *Arctic Marine Shipping Assessment* (AMSA IIC) maps prepared by the Arctic Council's Working Group on the Protection of the Marine Environment (PAME), the 2014 meeting in Helsinki to describe EBSAs noted in Lalonde's paper, and, most recently, a Workshop on Integrated Ecosystem Assessment for the Central Arctic Ocean, held in May 2015 by the International Council for the Exploration of the Sea (ICES) and the Arctic Monitoring and Assessment Programme (AMAP).

In addition to these international initiatives, all Arctic coastal states except the United States are actively developing MPA networks within their own Arctic waters. Together, these initiatives provide a good scientific basis on which to begin to build an ecologically connected, pan-Arctic network of MPAs.

Political support for moving forward is reflected in a constellation of recommendations that have been approved by the Arctic Council foreign or environmental ministers, including the report of the PAME expert group on MPAs, the recommendation of the *Arctic Biodiversity Assessment* to identify and protect ecologically and biologically significant marine areas, and a statement by the environment ministers of the eight Arctic states in February 2014 stressing the importance of implementing the Aichi Biodiversity Targets in the Arctic (which include protecting 10 percent of marine areas through ecologically representative and connected systems of protected areas). Non-Arctic states, most notably the European Union, are also calling for enhanced efforts to create MPAs in the Arctic.

The conservation benefits of creating a pan-Arctic network of marine protected areas are widely acknowledged. But there are other benefits as well. Protected areas where no commercial activity is allowed can help sustain subsistence hunting opportunities that are important to many coastal communities both in terms of food security and cultural heritage. Also, an Arctic-wide system of marine protected areas could strengthen the hand of the Arctic coastal states in a variety of international forums with decision-making authority over activities that could negatively affect resources within their exclusive economic zones (EEZs), including the International Maritime Organization (IMO) and any regional fisheries management organizations (RFMOs) that ultimately emerge to control high seas fishing. An Arctic network of MPAs would further represent a concrete step toward the development of a global consensus on the proper use and protection of Arctic resources. Finally, it would highlight the role of the Arctic states in the stewardship of the region, which would counterbalance the popular perception of an unbridled "race for resources."

NEXT STEPS

Once industrial activity becomes entrenched, it will be much more difficult to put into place an effective MPA network. It is therefore critically important to initiate a program of work to get this done quickly. Possible next steps include:

- *Identifying priorities for protection*—The Arctic Council Working Group on the Conservation of Arctic Flora and Fauna (CAFF), which has strongly supported the creation of a pan-Arctic network of MPAs, is currently working to update its 2004 map of existing MPAs in the Arctic. That work is expected to be completed this fall. An initial comparison between this map and existing maps depicting important ecological areas prepared under the auspices of national governments as well as PAME, the Convention on Biological Diversity (CBD), and others can provide a starting point for identifying priorities for protection.
- *Mapping ecological connectivity*—While a fair amount of work has been done to identify ecologically and biologically significant areas (EBSAs) in the Arctic marine environment, relatively little has been done to map ecological connectivity between those habitats and virtually nothing has been done to evaluate how those connections will change as the Arctic Ocean warms and the ice melts. Ecological connectivity is a relatively new frontier in the world of MPA networks, but the Arctic provides a unique opportunity to identify ecological connections and protect them before development makes that impossible. Such connections are obviously important in the development of an ecologically connected network of Arctic MPAs.
- *Identifying and Protecting Arctic Marine World Heritage sites*—As noted in Lalonde's paper, marine sites are seriously underrepresented in the World Heritage system, and the Arctic has nearly none. As a step toward addressing this gap, the United Nations Educational, Scientific, and Cultural Organization (UNESCO), along with IUCN and NRDC, will held a scientific workshop in November of 2015 to identify ecologically important areas in the Arctic marine environment that meet the criteria for marine World Heritage designation. It is hoped that the report of the workshop will be useful to the Arctic coastal states in considering potential World Heritage sites within their waters.
- *Managing activities in the Central Arctic Ocean*—Both the AMSA IIC exercise and the CBD Helsinki process identified the Central Arctic Ocean was identified as an ecologically and biologically significant

area. Much of the Central Arctic Ocean lies beyond national jurisdiction, which presents challenges when it comes to creating MPAs (there is currently no mechanism to create fully protected areas outside the EEZs of individual nations).

Nevertheless, the Arctic states can play a key role in setting appropriate norms and guidance for the protection of the Central Arctic Ocean beyond national jurisdiction (or the Arctic "high seas"). Fisheries officials of the five Arctic coastal states recently signed a declaration pledging to refrain from authorizing their vessels to fish on the high seas of the Central Arctic Ocean in the absence of appropriate management mechanisms. This represents an important first step toward broader protection of the high seas of the Central Arctic that can be built upon. A process is already underway to encourage other fishing nations to join the Arctic coastal states in refraining from authorizing their vessels to conduct fishing in the high seas of the Central Arctic until appropriate management measures are in place. Further, consideration should be given to whether a similarly pro-active approach should be taken to the conduct of other damaging activities, particularly those involving shipping noise, spills, and pollution, in the Central Arctic Ocean beyond national jurisdiction.

Thus, the time is ripe to move ahead with an ecologically connected, representative network of MPAs in the Arctic. The nongovernmental organization (NGO) community stands ready to work with governments to make the vision of a pan-Arctic MPA network a reality.

Notes

1. PAME, "Framework for a Pan-Arctic Network of Marine Protected Areas." Report of the Expert Group on the Framework for a Pan-Arctic Network of Marine Protected Areas (2015).

PART VI

HEALTHY COMMUNITIES IN THE ARCTIC: IDENTIFYING SUCCESS STORIES AND IMPROVING LIVING CONDITIONS

6. Identifying Success Stories and Improving Living Conditions in the Arctic

J. Okalik Eegeesiak

INUIT PRIORITIES

Inuit are the human face of the Arctic. Inuit are international peoples. As the international chair of the Inuit Circumpolar Council (ICC), I represent more than one hundred sixty thousand Inuit in Chukotka (Russia), Alaska, Canada, and Greenland. Our relationship within ICC is based on a common culture and language. For most of human history, the indigenous peoples of the circumpolar North have been at the top of the world, living their lives, and carrying on their traditional ways.

In the past decade interest in the Arctic has become widespread. In fact, it is global. This has all happened in a relatively short time. Until recently, not many people from the south have had an opportunity to visit Arctic regions. Transportation costs are high, distances are huge, and the climate is not for everyone.

Long before the advent of the Arctic Council, Inuit from Russia, Alaska, Canada, and Greenland understood themselves to be one people living across four Arctic states, undivided by borders. There were many bilateral gatherings among Inuit of different states, but it was not until 1977 that we saw the need to organize formally under one organization to deal with the new environmental, economic, and other global challenges of the time. The 1977 gathering of Inuit, in Alaska, led to the founding of the Inuit Circumpolar Council (ICC).

Through the ICC, Inuit reaffirm their unity and celebrate it formally through quadrennial general assemblies, the last of which was held in July 2014 in Inuvik, Canada. ICC works on circumpolar-wide and global issues that make a difference in local communities.

Through four country-specific offices of ICC and the office of the ICC chair, Inuit are able to express their concerns internationally within the context of national lenses when necessary. Through a variety of projects, declarations, reports, and presentations, ICC has become a voice for the collective expression of Inuit viewpoints. This collective mandate is developed during the quadrennial general assemblies where Inuit delegates from all four countries agree upon a four-year mandate, the most recent one being the Kitigaaryuit Declaration of 2014.

This brief background provides some context for the relationship between ICC International and the ICC country offices. In addition to ICC, there are other local, regional, and national Inuit organizations that engage in a number of activities that are particularly relevant to local communities and the challenges they are facing.

Even with the rapid and extensive increase in interest in Arctic affairs, Inuit constantly have to remind the world that we are here; the Arctic is not empty of human communities. Inuit in Alaska, Canada, and Greenland have negotiated with our respective national governments to secure a range of political, social, and economic rights. Things have not progressed as much in Chukotka.

We have our own systems of governance and we sometimes find it daunting that so many people and so many interests from outside the Arctic have such detailed and energetic plans for our future and for our homeland. Suppose the Inuit, Aleuts, Athabaskans, Saami, and numerous indigenous peoples of Russia convened a conference in your part of the world and laid out new ways for you to govern yourselves, set new priorities for research and development in your communities, imposed new rules for how you protect your local environment, and called for bans on which animals you can use on your farms and ranches. I suspect that you would not pay much attention to us!

It is appropriate to mention here the Kitigaaryuit Declaration that Inuit adopted in Inuvik, Northwest Territories (NWT), Canada in the summer of 2014. This declaration outlines the collective priorities of Inuit from the four Arctic states. It provides a mandate to Inuit leadership to work for a future that includes successful economic, social, and environmental conditions in the Arctic that reflect the central place of Inuit, Inuit culture, and Inuit values throughout Inuit Nunaat.[1]

Briefly, the Kitigaaryuit Declaration contains the Inuit agenda for the next four years in relation to:

- the Arctic Council and other international fora;
- environmental stewardship;
- safe shipping and fisheries;
- sustainable economic development;

- Inuit health and well-being;
- food security;
- communication;
- education and language; and
- traditional knowledge and Arctic science and research.

The Kitigaaryuit Declaration also mandates ICC to hold three important interrelated summits over the next few years: one on economic development, one on the sustainable use of wildlife, and one on education. These summits might provide opportunities for collaboration and cooperation with non-Arctic states, including Arctic Council observers, and non-state actors to support the efforts of Arctic communities to deal with change. More will be said on this point later in this paper.

There are many other activities that we also engage in at local, regional, and national levels, but our priority work falls mainly within the nine areas outlined above.

In many situations, we are working in multilateral processes where many other non-Arctic interests are represented. I have already learned quickly in my role as ICC chair that many other people have agendas that they want to have validated by having Inuit involved in their work. This can take a lot of time, money, and staff work to do. So it is important for Inuit to maintain a focus on their own priorities and their own agendas. When these priorities overlap, Inuit are effective partners.

We also have to be realistic. In the Arctic Council process, for example, the Arctic states set the agenda. Sometimes, the best we can do is try to influence their work to be sure they take Inuit views and interests into account. Inuit are committed to being equal partners and constructive participants within the Arctic Council. ICC finds the U.S. chairmanship program for the Arctic Council particularly encouraging.

Healthy communities are the goal of every nation and people. A healthy, food secure, and well educated population provides the opportunity to take advantage of economic change, adapt to environmental change, and survive and thrive in social and cultural change. ICC views the health and wellness of our youth and communities as the most important issue we have to address today. We also have a deep interest in climate change issues, the possible negotiation of a regional seas agreement, and sustainable economic policies in the Arctic. All these issues have direct and indirect implications for our local Inuit communities.

Inuit in all four countries suffer from rates of chronic disease, mental health issues (including high suicide rates), food insecurity, other health-related indicators, and inadequate education that exceed those of their southern counterparts. Inuit human-development statistics are closer to developing-nations' numbers than they are to the developed countries in which they are citizens (a fact not lost on the United Nations Human Rights Commission). This alone limits the ability of Inuit to benefit from the economic opportunities change in the Arctic is bringing. These human-development conditions rob our youth of a future and promise to keep Inuit from exploring the potential they have to offer the Arctic and the world.

Climate change has forever changed the nature and geography of the Arctic. Inuit have been and are resilient peoples and they are trying to adapt. They say given enough time whole forests can migrate as the climate changes. Cultures can adapt. But the rate of change in the Arctic is so rapid it threatens the ability of Inuit and our wildlife to adapt.

A regional seas agreement that establishes a system of management for the Arctic Ocean would affect Inuit and our communities across the Arctic. As I said at the outset, Inuit are an Arctic marine people. A regional seas agreement would engage many of the subject areas which the Kitigaaryuit Declaration has identified as Inuit priorities, namely the Arctic Council and other international fora as well as environmental stewardship, safe shipping and fisheries and sustainable economic development.

In addition, new management regimes in the Arctic Ocean could have implications for food security, traditional knowledge and science, communications, education and language, and Inuit health and well-being generally. We will need close coordination and consultation with all four regions in Inuit Nunaat to develop Inuit positions and strategies in relation to a regional seas agreement. Ensuring that the Inuit voice is heard in the negotiations will be critical because this agreement is likely to become a legal framework for years to come.

IMPORTANT CHARACTERISTICS OF THE CHANGES OCCURRING IN ARCTIC COMMUNITIES IN RECENT DECADES?

It is safe to say that Inuit were among the first to advocate for and to raise awareness, locally, nationally, and internationally, about the driving forces that are changing the Arctic.

Today, the Arctic is a barometer of planetary health. Activities in non-Arctic regions of the world are the primary forces driving Arctic change. Your scientists have researched and verified the observations our traditional knowledge holders have been making for the past thirty years. Climate change, transboundary pollutants, ocean acidification, increased demand for Arctic resources, increased shipping, and adventure tourism—all these have their roots outside the Arctic.

This change is driven by outside forces and solutions must be taken not only within the Arctic but also outside the Arctic. The bulk of greenhouse gas emissions that are resulting in climate change and loss of sea and glacial ice in the Arctic are not generated from activities in the Arctic. Nor are any economic advantages from these activities seen in the Arctic.

They are primarily by-products of human activities in non-Arctic regions where wealth is generated at a cost to the global commons. Transboundary pollutants, such as persistent organic pollutants (POPs) and heavy metals, that find their way into Arctic ecosystems, including the human population, are generally not the result of industrial activity in the Arctic. The growing demand for Arctic energy, fish, and mineral resources cannot be accounted for simply on the basis of consumption by local communities in the Arctic. Demand is driven by the burgeoning populations and rapacious appetites of billions of people who live outside the Arctic.

An example of collective action was taken on 16 July 2015 when the five Arctic coastal states (Canada, Russia, United States, Denmark, and Norway) signed a moratorium on commercial fishing in the Central Arctic Ocean (CAO), a major step applying the precautionary approach to Arctic development. The agreement calls for a moratorium on commercial fishing in international waters that lie beyond the five Arctic coastal states' 200-nautical mile (nm, 370-kilometer) exclusive economic zones pending further research on fish stocks and the development of a sustainable-management regime that includes Inuit traditional knowledge. The agreement will block ships from the five coastal states from dropping their nets in the CAO until the completion of a full scientific assessment of the fish stocks and how they can be sustainably harvested. While the Arctic countries cannot stop boats from China, Japan, South Korea, and the European Union from entering the region, the hope is that this agreement can set an example.

While climate change, transboundary pollutants, and demands for resources and new transportation routes tend to be driven by forces external to the Arctic, such changes do have significant impacts—some positive, some negative—on local communities in this region. On one hand, an upsurge in resource activity might create some opportunities for local people. However, on the other hand, historically such activity has proven to be socially, culturally, politically, and economically disruptive in many communities.

Responding to the positive and negative aspects of local changes often requires local action and, therefore, local, regional, and national governments and organizations are engaged. International involvement in local affairs is less common.

Nonetheless, international action by non-Arctic states and non-state actors is critically important to the Arctic. This is because one of the often-disregarded aspects of Arctic change is the need to take action outside the Arctic to address the major drivers of Arctic change. No amount of tinkering with Arctic governance systems or adaptation measures can reduce the greenhouse gas emissions of the rest of the planet. No amount of food inspection or education about pollutants in country foods can reduce the amounts of transboundary pollutants migrating into the Arctic from industrial regions elsewhere on the globe. No amount of Arctic fisheries-survey work or Arctic fisheries-management work can address the depletion of fisheries in more southerly oceans.

In other words, many of the social, cultural, and economic challenges faced by Inuit in communities today are influenced by global factors such as climate change and globalization. This is why ICC supports the proposed themes and projects for the U.S. Arctic Council chairmanship: addressing impacts of Arctic climate change, stewardship of the Arctic Ocean, and improving economic and living conditions in the Arctic. All these matters are crucial to the Inuit and, indeed, they are indivisible from our identity, way of life, and our future.

The U.S. chairmanship program's elements relating to the theme of improving economic and living conditions are of particular interest. We were pleased about reassurances for projects to continue including those on indigenous languages, traditional knowledge, suicide prevention, and mental wellness. These projects relate to challenges the Inuit are experiencing as a result of economic, social, and cultural change. In a letter to Secretary of State Kerry, I strongly urged that the United States chairmanship program include two other critical priority areas, namely food security and community housing.

ICC believes that we cannot simply view the Arctic as a region for observance, documenting and describing the changes occurring in the Arctic. It is critically important to act on the lessons the Arctic is teaching humanity and to make timely moves to address some of the positive and not-so-positive changes that are occurring. Sheila Watt-Cloutier, former chair of ICC and nominee for the Nobel Peace Prize in 2007, reminds us that the world is connected. What we do in one region impacts another. As the Arctic ice melts, smaller island developing states are threatened by sea level rise.

HOW COMMUNITIES HAVE RESPONDED AND SOME "SUCCESS STORIES"

The ICC is a strong and well-respected organization in many international processes where we have been leaders in breaking new ground, advocating for Arctic-specific, indigenous-focused perspectives. For example, ICC was one of the first indigenous bodies to gain United Nations Economic and Social Council (ECOSOC) nongovernmental organization (NGO) category II status in 1983. ICC uses these kinds of internationally recognized processes to interact with those that carry out activities that might impact the Inuit Nunaat.

ICC was instrumental, in partnership with other indigenous peoples organizations, in helping negotiate such instruments as the United Nations Declaration on the Rights of Indigenous Peoples. ICC was also central in advocating for a United Nations Permanent Forum on Indigenous Issues and has played an active role there.

In addition, ICC is a strong influence on other international processes, such as in the recently concluded international Minamata Convention on Mercury, the Nagoya Protocol on access and benefit sharing, and, in the 1990s, the Stockholm Convention on Persistent Organic Pollutants (POPs), among others.

Of course, ICC also participates robustly inside the Arctic Council, a circumpolar forum that is among the most important for ICC.

However, local communities generally have limited means to deal with the big external issues facing them. Like small communities elsewhere, they must deal with the immediate issues of feeding, sheltering, employing, educating, and caring for the health of their local people. The human and financial capacity of most Inuit communities is limited, and the prohibitively high cost of hiring expertise from outside is an important factor. The recent action by Clyde River, a community of eight hundred people, to oppose seismic testing by a large oil consortium in their waters until impacts to wildlife were better understood is an example of the ability of Inuit communities to defend their rights.

The Nunavut territory in Canada provides a graphic example of the sorts of challenges facing many Inuit communities across the Arctic. Imagine a population of thirty-six thousand people inhabiting twenty-five communities across one-fifth of Canada (1.9 million km^2). Now imagine that over 50 percent of that population is below the age of fifteen years.

So, roughly twenty thousand adults administer:

- twenty-five airports;
- twenty-five water and sewage systems;
- twenty-five solid waste sites;
- forty-four schools;
- one hospital, two health centers, and twenty-two nursing centers;
- twenty-five sets of community and recreation facilities;
- one legislative assembly;
- ten territorial government departments; and
- four land claims regulatory bodies.

This same tiny population also runs a network of numerous Inuit organizations, runs a range of small businesses and enterprises, and builds and maintains infrastructure. Although not without significant challenges, this is, in itself, a success story.

PUBLIC POLICIES AND INSTITUTIONAL ARRANGEMENTS THAT COULD IMPROVE THE ABILITY OF ARCTIC COMMUNITIES TO DEAL WITH CHANGE

There are many issues that will challenge all of us in the twenty-first century. We certainly need the good ideas, hard work, and innovation of people from the south. We can do more to enhance our future work and to base our respective policies, regulations, restrictions, and opportunities upon traditional knowledge as well as experience with sound research, appropriate messaging, and sustainable and equitable programs and services.

To be specific, the Arctic states, and especially the Permanent Participants, are the more appropriate authorities to determine and decide when and if there should be trade restrictions on seal products, not the European Union. Arctic states and their indigenous peoples should be the go-to experts when discussing and determining the health of their wildlife species, such as the polar bear, walrus, and bowhead whale.

Peoples of the Arctic require jobs and livelihoods to continue to live where they have always lived, not only to survive but also to thrive in their homelands. We welcome appropriate economic activity that respects the natural environment and includes Inuit in ways that support and respect our culture, our traditional knowledge, our communities, and our collective and individual human rights.

ICC and other organizations acting on behalf of Inuit have always been deeply aware of the importance of engaging in policy development, implementation, and evaluation to meet changing situations. As an example, Inuit recently released a report entitled *The Sea Ice Never Stops: Circumpolar Inuit Reflections on Sea Ice Use and Shipping in Inuit Nunaat*. This report investigates Inuit use of sea ice in the Arctic. It looks at existing sources of information regarding land use and occupancy to understand sea ice use, augmenting this with responses from interviews with Inuit hunters from Canada, Alaska, Greenland, and Chukotka to provide a pan-Inuit perspective. It includes broad predictions about the future in light of climate change and reduced sea ice based on the experience and traditional knowledge of Inuit hunters.

The central thread running through this study is that Inuit are a maritime people: our culture and identity are based on land use, occupancy, and free movement over the sea and sea ice. We rely on free movement, first and foremost, in order to eat, since so much of our diet is derived from hunting.

This mobility is also essential in trade, communication, and obtaining supplies for traditional clothing and art as well as to enhance pride in our rich cultural heritage.

Cultural diversity is a valuable global asset.

Inuit share a common culture based on similar hunting, fishing, and whaling practices. There are regional variations because certain communities have easier access to various species. But the centrality of sea ice to our culture and physical survival is something that we hold in common.

Because the goal of the report, *The Sea Ice Never Stops . . .*, was to give voice to Inuit perspectives and concerns regarding the impact of changes in the Arctic, the text includes many direct quotations from Inuit residents of the North. Many interviewed for the report emphasized the importance of the sea to their everyday lives, and they are deeply concerned that their voices be heard by the people whose decisions will affect their culture and livelihoods. The use of direct quotations is our means of presenting their concerns to a wider public.

Three words summarize ICC's perspective on the reform of public policies and institutional arrangements to improve the ability of Arctic communities to deal with change: inclusiveness, responsiveness, and respect. Inuit need to be involved in decision making that affects the Arctic region. Our views, interests, and objectives need to be respected, and there needs to be balanced and sustained efforts, inside and outside the region, to address the threats and challenges facing Arctic communities and the Arctic generally.

ICC has a mandate to promote and protect the Inuit way of life, including the core principle of sustainable utilization of renewable resources and land use, at international forums. Inuit in both Greenland and Canada have established governance structures and institutions to undertake environmental and wildlife research and policy development. They welcome partnerships with government, NGO's, and industry that contribute, enhance, and support the Inuit vision. In my own country, Canada, for example, Inuit are the largest landowners in the Arctic, after the government of Canada, having some level of ownership over 40 percent of Canada's landmass.

Inuit also have a great deal of knowledge and insight to offer to support research efforts on Arctic change, wildlife, sustainable use, and traditional knowledge. Inuit have acquired detailed and holistic knowledge about their environment and can best document changes that are taking place. Inuit traditional knowledge of the Arctic and its changes is valuable; we bring a millennium of data collection to the table and our knowledge holders collect data twelve months of the year. Therefore, partnerships in research are crucial to understand the meaning of scientific findings, to explain and document changes, and to ensure this research informs management decisions.

In Canada, Inuit have constitutionally protected rights under land-claims agreements to land use. Inuit in Alaska have negotiated agreements respecting their traditional territories. The Greenland government legislation gives rights for land use to Inuit. Any decisions on land use or designations need to have the support of Inuit.

Inuit are aware that the Arctic has great resource wealth. We are also aware of the increasing global demand for Arctic minerals, hydrocarbons, and living marine resources. Inuit have always adapted to change with seasons and animal migration patterns, and we are using this adaptation experience to provide for the material and cultural well-being of Inuit as more and more interest comes to the Arctic.

This is why Inuit adopted the Circumpolar Inuit Declaration on Resource Development Principles in Inuit Nunaat in May 2011. We are committed to the principles on resource development set out in this declaration. Inuit expect all those who have or seek a role in the governance, management, development, or use of the resources of Inuit Nunaat to conduct themselves within the letter and spirit of this declaration.

OPPORTUNITIES FOR OUTSIDERS, ASSOCIATED WITH BOTH NON-ARCTIC STATES AND NON-STATE ACTORS, TO SUPPORT THE EFFORTS OF ARCTIC COMMUNITIES TO DEAL WITH CHANGE

Inuit are mindful of the great potential that observers represent for the work of the Arctic Council. We have taken the initiative in preparing a document for how Arctic Council observers can start to build upon the Arctic Council work with us through a meaningful and principled approach. In this document, entitled "A Meaningful and Principled Approach for Inuit Engaging Arctic Council Observers" (March 2015), observers are asked to understand that while we have demonstrated that we are an adaptive people, our history has taught us to be cautious. In some cases, Inuit across Inuit Nunaat continue to suffer with great anguish because of the way in which we have been treated by outsiders and the way in which partnerships were forged with us. On the other hand, there have also been healthy, mutually supportive partnerships that have played mitigating and, in some cases, positive roles in the face of change.

Inuit see the potential for positive, as well as the potential for negative, outcomes in our analysis of the objectives of "new-to-the-Arctic" states, industries, and nongovernmental organizations who want to play a role in the development of today's Arctic.

While Inuit live across a vast territory in the Arctic, our population is miniscule in comparison to the populations of observer states. Our access to financial resources is equally small in comparison to the overall budgets of these same states. Observers are reminded that Inuit have demonstrated ability to take on large initiatives—oftentimes in partnership with large corporations and governments—and contribute to them successfully. This past experience provides an indicator of the breadth and scope of the partnership model Inuit aim for in the future.

Through organizations such as ICC, Inuit have forged numerous multi-partner alliances, mostly with other indigenous peoples organizations. Some of these relationships have been project-driven (for example, at the Arctic Council). Others have been issue-driven (for example, the United Nations Declaration on the Rights of Indigenous Peoples). In considering the impact of new partnerships, Inuit look to the past in another important respect: the most successful partnerships have been built upon bilateral relationships. Likewise, when it comes to potential partnerships with observer states and other non-state observers, Inuit see the best chances of success coming through one-on-one relationships. Observers are reminded that Inuit are a people among many indigenous peoples and that we not only have our own identity, history, and way of life, but Inuit are also a people who have developed, over time, our own institutional infrastructure, corporate culture, and way of doing things. As such, we urge observers to enter into bilateral discussions with us.

Because we understand some observers may be interested in engaging Inuit on matters that touch, directly or indirectly, upon resource development, we encourage any prospective partners to consult the Circumpolar Inuit Declaration on Resource Development Principles in Inuit Nunaat (2011). In this declaration, observers will see that Inuit support projects that promote environmentally prudent, culturally enhancing, and appropriately paced development projects that are mutually beneficial. An early dialogue, therefore, on such intentions with ICC, through a communications project or other pre-feasibility process, may offer the best chance of eventual success.

The March 2015 paper on relations with observers aims for clarity by providing Arctic Council observers, in a transparent way, with information on who the Inuit are and the conditions upon which Inuit would be interested in developing partnerships. Inuit welcome a similar transparent response that articulates the intentions of those seeking partnerships and, in particular, the mutually beneficial aspects that observers see in such enterprises. As well, Inuit seek partners that have a demonstrated track record of supporting indigenous peoples in the past and that have shown support for cultural diversity in their own country.

In addition, the March 2015 paper provides the following principles for the consideration of observers in, and for Inuit review of, contemplated new partnerships:

- Principle #1—Observers demonstrate their desire to learn from Inuit and demonstrate this by coming to meet Inuit leaders in Inuit Nunaat.
- Principle #2—Observers recognize that Inuit are a maritime people and have deep connections to the Arctic Ocean and its contiguous seas.
- Principle #3—Observers commit to a bilateral (observer to ICC) exploration of common objectives.
- Principle #4—Observers agree to help strengthen ICC involvement at the Arctic Council in all ways and that their activities at the Arctic Council will not diminish or dilute the direct and meaningful role ICC and other indigenous peoples organizations have achieved through their status as permanent participants.
- Principle #5—Observers agree to support ICC's priorities, such as summits and other mandates, found in the Kitigaaryuit Declaration.
- Principle #6—Observers have demonstrated support for cultural diversity in their own country.
- Principle #7—Observers show that the assistance to ICC will not detract from support to their own indigenous or tribal peoples.
- Principle #8—Observers agree to the United Nations Declaration of the Rights of indigenous Peoples.
- Principle #9—Observers fully understand the contents and intent of the 2009 Circumpolar Inuit Declaration on Sovereignty in the Arctic and the 2011 Circumpolar Inuit Declaration on Resource Development Principles in Inuit Nunaat.

ICC is eager to work with any observer that adheres to these principles.

CLOSING MESSAGES

In summary, I want to leave you with two key messages. The first is a cautionary message to those who might see the Arctic as an empty wilderness or an open frontier where they have complete license to assert their own interests. The second message is an offer of partnership, cooperation, and collaboration.

Message #1

The Arctic is not empty. Indigenous peoples have lived in this region for thousands of years. They have their own languages, cultures, systems of government, and livelihoods. They also have their own aspirations for their homelands and expectations about relationships with other parts of the world.

For whatever reason, many newcomers to the Arctic see the Arctic as a governance vacuum, a region that should be considered the common heritage of mankind, or, at least, a region where virtually anyone should be free to offer a myriad of new management, governance, and research ideas. About 20 percent of the Central Arctic Ocean can be considered as exclusively international space. The rest of the land and sea in the Arctic is subject to the sovereignty or the sovereign rights of the eight Arctic states with, of course, a range of rights in respect of navigation in the airspace and water columns above territorial seas and exclusive economic zones. Inuit live in four of these eight Arctic states and have a variety of legal and political rights protected by domestic and international law.

Those who are new to Arctic issues often overlook the people who live in the Arctic and minimize the importance of existing governance systems and local interests and priorities. In 2009, Inuit adopted a Circumpolar Inuit Declaration on Sovereignty in the Arctic. In this declaration, we stated that the conduct of international relations in the Arctic and the resolution of international disputes in the Arctic are not the sole preserve of Arctic states and non-Arctic states. These matters are also within the purview of the indigenous peoples of the Arctic.

Issues of sovereignty and sovereign rights in the Arctic have become tightly linked to issues of self-determination in the Arctic. Inuit and Arctic states must, therefore, work together closely and constructively to chart the future of the Arctic.

But the Inuit voice is not just an Arctic voice. Inuit are part of the global family of indigenous peoples and we are also involved in promoting and protecting indigenous peoples' rights through the United Nations. Inuit were pleased to see the United Nations General Assembly adopt the outcome document at the World Conference on Indigenous Peoples in New York last September. The outcome document contains important language. States commit themselves to make an effort to implement the Declaration on the Rights of Indigenous Peoples locally, nationally, and internationally in cooperation with indigenous peoples.

Message #2

Inuit are pragmatic and adaptable people, and we welcome partnership, cooperation, and collaboration with those who have recently become interested in the Arctic.

Many opportunities for partnership and collaboration arise from activities in bodies such as the Arctic Council. In the Arctic Council, there is a lot of important work going on. Working groups and task forces are thinking about issues such as climate change, marine transportation, renewable and nonrenewable resource development, transboundary pollution, and Arctic biodiversity. With our limited resources we struggle to keep up. We do not currently have the capacity to attend and contribute to all working groups and activities as much as we would like. So we are watching to see if there is substantive progress on issues like the permanent-participant capacity-building workshops that took place during the Canadian chairmanship of the council from 2013 to 2015.

It is critically important that ICC continues to play a strong role in forums such as the Arctic Council. As an organization, ICC predates the Arctic Council by about twenty years. In the 1970s, our Inuit leadership saw the need for us to come together to deal with exactly the kinds of challenges we are facing today. But as Inuit, we have always understood that change in the Arctic brings opportunities as well as challenges.

Inuit have always been incredibly resilient and capable of adapting to challenging environments. But, as Inuit, we do not think about these issues in a detached, scientific way. These issues and many others affect us day-to-day.

Inuit look at current issues from the perspective of what impact they will have on our language, our culture, and our traditions and on the future of our children and communities. In order for us to contribute to the sustainable development of our communities we need to ensure a healthier, well-housed, and experienced Inuit labor force. The potential for a diversified Arctic economy in renewable and nonrenewable resource development must be matched by educated and trained Inuit. It is critically important that Inuit are grounded by our culture and our respect for the lands and waters where we live. I think this represents a different perspective than the one taken by many of the government officials and scientists who participate in Arctic Council activities.

We simply ask that you respect our culture and long history as residents of this unique and beautiful region of the planet. And we ask that you consult with us before you try to reinvent the Arctic according to your own interests.

There are many issues that will challenge the indigenous peoples of the Arctic in the twenty-first century. We can use the good ideas and hard work of people from the south.

Peoples of the Arctic require jobs and livelihoods so they can continue to live where they have always lived. We welcome appropriate economic activity that respects the natural environment and includes Inuit in ways that support and respect our culture and our communities.

But if you want to help the Arctic, I also encourage you to think about what you need to do differently in the south, in the places where you live.

Rather than suggesting to us how we should govern ourselves differently in the North, consider how your activities in the south are impacting us in the Arctic and make some adjustments closer to home. Some of the challenges, such as reducing the pace of climate change or the spread of transboundary pollutants, will require you to do more work at home because these problems are not being driven by Inuit communities and activities in the Arctic. In addition, some of our Arctic resources, such as fish, are attracting global interest only because fisheries in more southerly latitudes are depleted or close to depletion. Humanity requires innovation and proper management of the more productive areas of the world's oceans. If the Arctic is the last stop for humanity in its quest for food sources, quite frankly, we are all in serious trouble.

I want to be clear that I am not suggesting that Inuit want to close the Arctic to others. We realize that the enthusiasm and interest of people and organizations outside the Arctic are generally built on good intentions. ICC is always interested in opportunities to develop partnerships and work in cooperative and collaborative ways. So, I look forward to meeting many of you and discussing your interests in and support for the Arctic at this conference and into the future. And I look forward to working with you.

Inuit constantly try to envision the Arctic in 2020, 2050, and beyond. I have reflected on how ICC can better connect with the communities it represents, how ICC can continue to grow as a recognized international voice, and how ICC can inform and be acknowledged as part of the global community for the betterment of Inuit.

Since ICC was created, Inuit, successive governments, and partners have benefited when we discuss, collaborate, participate, negotiate, and agree. Inuit matter in the discussion of the future of the Arctic and the world as a whole.

Nakurmik!

For more information see:

- A Circumpolar Inuit Declaration on Sovereignty in the Arctic (2009);
- A Circumpolar Inuit Declaration on Resource Development Principles in Inuit Nunaat (2011);
- Kitigaaryuit Declaration (2014). and
- A Meaningful and Principled Approach for Inuit Engaging Arctic Council Observers (2015).

Notes

1. Inuit Nunaat is the name Inuit use to describe the traditional Inuit homelands across the four Arctic states.

Commentary

Kenneth (Ken) S. Coates and Carin Holroyd

The chair of the Inuit Circumpolar Council has delivered a clear and precise outline of Inuit agendas in the contemporary North. Eegeesiak has provided much guidance over the years to the Inuit people of Canada and the circumpolar world. She has been extremely gracious in sharing ideas and insights with non-indigenous peoples and governments. She has done so here again today, reminding us, in the peaceful but firm manner that characterizes Inuit international engagement, that the Arctic is not an empty space, that the Inuit and other circumpolar indigenous peoples are resilient and adaptable, and that they face many new and expanding challenges, most associated with the impact of global economic and environmental forces on the Far North.

The session on "Healthy Communities in the Arctic: Identifying Success Stories and Improving Living Condition" seeks to reflect on the changes that are occurring in the North and to identify the best means of improving indigenous life in the region. This is no small task. Northern indigenous populations face enormous pressures for change, starting with fundamental recalibrations of the Arctic ecology through to language and culture loss associated with modern communications and media. The Inuit are the first to say that these threats are not unique to their people and communities but are part of a global struggle of indigenous peoples for cultural stability and political, economic, and socioeconomic well being.[1] Their greatest challenge is that the world's attention is focused on their region, largely because of the desire to exploit Arctic resources. Their greatest external opportunity rests with the engagement of the world's major powers who, collectively, are responsible for the ecological changes in the North and whose technological and economic power could and should be harnessed to the benefit of Inuit people.[2]

The situation is not as new or original as most people assume. In the late nineteenth and early twentieth centuries, commercial whalers ventured east from the Bering Straight into what is now the Canadian western Arctic, discovering large pods of whales off Herschel Island and in the Beaufort Sea. Their arrival brought major transformations, including the devastation of local whale stocks, serious disruptions of Inuit life, significant population loss, and the eventual and belated arrival of the government of Canada. During this time, and in the era of the silver-fox trade that followed, the Inuit adapted quickly. They seized upon new technological advances, from telescopes to record players, bought motorized boats when they came available, and proved particularly adept at melding traditional Inuit lifestyles with those imported technologies that added value to their lives. Indeed, the Inuit have long been proficient at figuring out how to make the most of global imports and how to select those items that improved the quality of life in the North. Conversely, when satellite television first came to the Canadian Arctic in the 1970s and 1980s, several Inuit communities resisted the intrusion of the new communications systems, fearing (as history would show, with good reason) the impact on language and culture of easy access to southern, non-Inuit television. Even here, however, the Inuit (through the Inuit Broadcasting Corporation) have been among the most creative indigenous peoples anywhere in adapting television and other media to meet Inuit cultural and other needs. The twenty-first century did not invent rapid technological change, nor is this the first time that the Inuit have had to respond to the multifaceted threat of ecological transformation, technological shifts, economic reorganization, and social adaptation.[3]

The twenty-first century does stand apart from earlier eras in many respects, including the scale and pace of environmental change, the distant sources of the ecological dangers, the scale of international engagement and interest in the Far North, the appearance of non-Arctic actors as major contributors to northern affairs, the intense media coverage of Arctic affairs, the diversity and cost of technological innovations, and, perhaps most importantly, the nature of Inuit control, engagement, and priority setting within the new North. As Eegeesiak outlined, the Inuit have clear agendas and they expect national governments and international partners to line up behind their priorities. The twenty-first century is also marked by a sense of urgency, particularly around cultural change and socioeconomic well being, and the intensity and speed of Arctic transformations, all of which present significant public-policy challenges for Arctic peoples.[4]

As this relates to the transformative potential of new technologies, two questions stand out:

- How can new technologies create better social, economic, and cultural outcomes in the Far North?
- How can we ensure that the latest technologies are used for the

betterment of life in the Arctic?

There is a simple backstory that underpins the comments that follow. We live in a world of transformative technological change. While everyone knows of the impact of the internet, including search, mass data, the greatest explosion of information accessibility in world history, social media, e-commerce, and the like, much less attention has been focused on the broad sweep of technological change. Scientists the world over have made enormous innovations in medical technologies, educational systems, language-based programs, new materials, innovative energy systems and energy-storage systems, water-purification plants, transportation, biotechnology, and countless other items, services, and products.[5]

The changes have been massive. Impoverished people in isolated corners of Africa have cheap and reliable Internet service. New water-purification systems have improved the quality of water supplies around the world. Plant research continues to enhance the productivity and resilience of food crops. Drones are replacing ground-based mineral-exploration teams. New drugs and surgical techniques are improving life expectancies and the quality of life for people living with disease. New preventative measures are saving hundreds of thousands of lives (although sometimes the appropriate technologies are as simple as inexpensive mosquito nets in the tropics).[6]

The scale of the opportunity is remarkable. Some suggest that more than 90 percent of the scientists who have ever lived are alive today.[7] The global production of knowledge, which is doubling every two years, greatly outstrips our collective capacity to capitalize on what people have learned.[8] The rapid explosion in the number of universities, faculty researchers, and students is likely to ensure that the innovation trajectory continues to accelerate.[9] The commercialization of these technologies, including such high-profile areas as smartphone technologies and much-less-known areas such as robots and medical implants, has continued apace, creating entire new business sectors, adding millions of jobs, eliminating even more millions of "old economy" positions, and upsetting regional and national economies.[10]

What these things also share in common is that most have not had a sizeable impact on the circumpolar world. Arctic innovation lags well behind other areas, a function of small populations, formidable technological challenges (especially with the Internet), the relative absence of Arctic-based innovation centers, and uncertainty about market viability and regional need. The Arctic—and there have been innovations and developments of some note, especially as regards northern safety, telecommunications, and scientific monitoring—is far behind most other places as a zone of constructive, life-improving innovation. Twenty years ago the world spoke with concern about the "digital divide," which meant access to computers and the Internet, a global problem addressed largely through the advent of smartphones.[11] Now, there is a potentially more serious "innovation divide," which focuses on the capacity and resources to harness scientific and technological innovation for the betterment of local populations.[12]

THE PROMISE AND POSSIBILITIES OF TECHNOLOGICAL CHANGE

A good deal is known about the negative and harmful consequences of the modern industrial world on the Arctic. While the full effects of climate change are known only in part and continue to unfold, much less is understood about the impact of other technological and scientific innovation. Consider the impact of e-commerce, or Internet-enabled business activity, on northern regions. On the one hand, the Internet puts the entire retail world at the fingertips of anyone with a decent Internet connection. With the likes of Amazon, Alibaba, Rakuten, and thousands of other online buying sites available throughout the world, shoppers in the Far North have access to millions of items at globally set prices, albeit with high shipping costs added.[13] At the same time, the fact that Arctic residents with high incomes, the majority of whom are non-indigenous people, are able to shop in familiar southern stores using the simple combination of an Internet connection, a web-browser, and a credit card means that local stores, often in precarious financial positions, are unable to compete on price, quality, and selection. The result is that they lose business. In some communities, Internet shopping (combined with shopping during visits to regional capitals) has undermined the viability of local retail operations. Furthermore, people with lesser incomes and without ready access to websites (often because of linguistic barriers) are unable to participate in the world of online shopping. Instead, they rely on local stores that charge high prices and offer small selections.[14]

There are many technologies, already available or emerging soon, that likewise have the capacity to change northern realities, sometimes in constructive ways and sometimes in a disruptive manner. Consider a list of ten technologies or technology-based solutions, all of them operating within the realm of imminent serviceability in southern markets, that could be of particular relevance to northern settings.

- *Food factories*—The technology exists to construct self-monitoring and self-harvesting food factories that will produce fresh vegetables on a regular basis, often capitalizing on waste heat from public buildings and using local and/or volunteer labor. The benefits in terms of food security in the North and the ready availability of fresh produce are obvious (provided people can be convinced to consume substantial quantities of lettuce, kale, and the like). These factories can be developed on a village-size scale and do not need industrial-size operations to be financially viable.[15]
- *Medical monitoring*—The high cost of medical services and the inadequacy of health monitoring contribute substantially to the social costs of contemporary northern life. New technologies that range from contact-lens-based diabetes monitoring to automated, tablet-based, diagnosis and monitoring systems are already available and could quickly overcome a major liability of social-service provision in the Arctic. That toilets can already be designed to do automated medical (and drug) testing demonstrates the potential of this field.[16]
- *Small scale nuclear reactors*—Recent innovations in nuclear technologies suggest the possible availability of village-size, self-contained nuclear reactors that are easy to maintain and that provide safe, stable, and inexpensive energy in isolated locations. Removing the dependence on imported fuel oil would provide enormous cost-savings for remote Arctic communities.[17]
- *Remote surgery and medical care*—Recent advances in Internet-based medical interventions, ranging from advanced surgeries to mental-health diagnosis and treatment and nursing care, would assist with the ongoing challenges of finding medical professionals to live and work in the North and, even better, have the potential to provide high-quality medical care to isolated communities.[18]
- *Drone technologies*—Drones have already established a significant presence in mineral exploration. As the drones improve, particularly in terms of travel distances, the survey technologies will allow for even

greater exploration coverage, better search and rescue capabilities, specialized product delivery, and many other functions that would be particularly well-suited to northern locations. The utility of these tools in wildlife monitoring should be obvious; they are already being used to assist with the control of poaching in Africa.[19]

- *Immersive educational systems*—At present, educational adaptations based on the Internet and digital technologies are quite basic, offering systems for interactive classrooms and "online courses." Emerging innovations encourage immersive environments—essentially video games developed for educational experiences—that provide for a high level of student engagement and experimentation. For Arctic communities that struggle to provide high-quality educational experiences for small student populations, these new systems could address the most fundamental educational challenges in the region and could reduce the need, in full or in part, for community-based teachers.[20]
- *Digital translation systems*—Almost twenty years ago there was Babel Fish. Now there is Google Translate. Already under development are functional systems that allow speakers of different languages to carry on, without additional professional intervention, real-time conversations with each other. These automated translations would allow an Inuktitut speaker to carry on a simultaneous three-way digitally translated conversation with native Japanese and Korean speakers, overcoming one of the most fundamental challenges for linguistically small populations seeking to connect with the broader world.[21]
- *Automated vehicles*—Google has attracted global attention for its driverless cars, generating considerable consternation about the prospects of thousands of such vehicles heading down the highways of the world. Automated vehicles have enormous application in the Far North, for they potentially permit companies and organizations to operate driverless trucks and other vehicles at considerable distances from their home base. The impact in terms of human safety would be considerable. So would be the loss of jobs for northerners.[22]
- *Automated industrial applications*—Much has been made about the expansion of robotics within industrial operations and factories. The potential utility of these systems in the resource field is well known within the corporate sector. Norway has its first fully automated

offshore oil rig, a particularly useful innovation in Arctic waters. The country is also experimenting with remote-controlled snowplows at the northern airports. Automated mining operations are a current possibility and a future likelihood, with a related large-scale drop in resource-based employment.[23]

- *Remote work*—Almost all the technologies, while promising considerable improvement for northern communities, carry a potentially significant cost in terms of lost jobs. If these various innovations were implemented, the North would need fewer teachers, nurses, doctors, truck drivers, miners, and many other workers, particularly those with few or limited skills. The same technologies that could strip work out of the North could also produce new opportunities, if properly implemented. Northerners could stay at home and work on a thousand varieties of Internet-based work, from video-game development to professional-services provision, medical oversight, or educational services. Of course, all these jobs could equally be done in non-Arctic locations and many have already migrated to areas of low wages and decent education, such as China, India, and Thailand. It is possible, however, to imagine ways of training and mobilizing Arctic residents to work in a digitally enabled fashion and therefore to earn a decent income while remaining in their communities.[24]

RESPONSIBILITY FOR REGIONALLY-APPROPRIATE TECHNOLOGICAL CHANGE IN THE ARCTIC

Futurologists struggle to understand and explain the likely effects of technological change, particularly as this relates to the quality of life and health of human populations. Some are forecasting the imminent collapse of the industrial workforce, with little understanding of what will replace the low-skill/high-wage work that has long been the backbone of the Western industrial economy. Others paint pictures of a technological nirvana, where innovations address all of society's ills, liberate the individual, create meaningful work for everyone, and produce, no doubt, world peace and end global change in the process. The reality is that no one knows what the immediate, let alone the long-term, future will bring. Few people anticipated the rise of Google or Facebook and a still smaller number understand the potential reach of Alibaba and its potential for local-level entrepreneurship.[25] The impact of gamification technologies, emerging out of the video-game industry, is little understood by politicians and the public.

There are countervailing influences around the adoption of new technologies. Professional groups, including doctors, nurses, accountants, and lawyers, worry about the impact of new technologies on their work and incomes. Their resistance to large-scale implementations of labor- and cost-saving technologies can be presumed. Furthermore, client populations play a major role in determining receptiveness to new technologies. Japan and South Korea are perhaps the most digitally enabled populations in the world, and both societies are open to the adoption of technological solutions and the replacement of human workers with robots or digital processes.[26] North Americans, including northern indigenous peoples, lag well behind in their openness to new technologies and labor-saving devices.

In the excellent paper that framed our conversation about healthy communities in the Arctic, Eegeesiak challenged us to remember the fundamental importance of learning from and with the Inuit when planning major changes in Arctic policy. If we have learned anything from the past fifty years—and history shows us that governments and dominant societies learn slowly indeed—it is that governments and businesses must collectively respect the perspectives of Inuit and other indigenous peoples on what is needed and wanted in the North. In terms of major and sweeping technological change, currently happening one smartphone at a time, there have been few such consultations and little dialogue outside of specific professional, occupational, and agency circles. Drawing on Eegeesiak's clearly outlined approach, the technological transformation of the North must be approached in a manner that respects the needs, aspirations, and values of northern residents.

It is clear that the Arctic suffers from a relative absence of innovation capacity. The few Arctic universities and colleges do not have the same resources that are being focused on southern innovation. The global philanthropists who have been driving community-level innovation for the "bottom billion" (the world's poorest peoples[27]) have, to date, shown little interest in the Arctic, clearly (and with justification) believing that this work properly belongs with the wealthy national governments that have responsibility for these regions. There are promising signs of home-grown northern innovation. The University of Tromsø (Norway), Luleå University and Umeå University (Sweden), the University of Lapland and Oulu University (Finland), the University of Alaska (United States), and Yukon College (Canada), among others, are making real contributions. But their work is small change in a massive global innovation industry. The North moves forward in steps while the rest of the world jumps forward in leaps and bounds.

Specifically, planning for an Arctic technological revolution that meets Arctic needs on terms consistent with the aspirations of Arctic peoples could properly proceed as follows:

- Arctic communities must be consulted in order to identify, without reference to specific technological or scientific solutions, their most pressing needs. The initial focus should be on problem identification and the production of a list of items that would contribute specifically to the improvement of the quality of life for Arctic residents.
- Based on this comprehensive understanding of the most pressing northern requirements, a panel of scientific and technological innovators should be assembled to meet with Arctic representatives in order to review regional priorities. The innovators would examine the needs, look for overlaps and symmetries, and begin the process of considering potential commercially and technologically viable solutions.
- Arctic representatives and innovators, working collaboratively, should develop a common call for action that connects needs and potential solutions. This call for action should be sent to leading think tanks, research institutes, and government agencies, focusing on the non-Arctic states that are eager to make a contribution to the Far North. This, incidentally, is an area where Japan, South Korea, and China have the potential to make major contributions. Indeed, this exercise in practical technology development could well be financed by these countries and other nations as a leading means of improving human well-being in the North.
- Based on the best scientific and technological input and on a systematic assessment of the costs and technological challenges involved in responding to Arctic needs and aspirations, the participants should draft a comprehensive strategy for Arctic innovation. This strategy would form the basis for collective action led by northerners and their governments but supported

by researchers, innovators, companies with Arctic interests, philanthropists, and others eager to contribute to the improvement of Arctic life.

- A global strategy for Arctic innovation would be rolled out collectively, raising the profile of scientific and technological innovation as a contribution to northern life, and likely involving a series of test implementations across the Arctic. Done properly and based on Inuit leadership, this strategy could emerge as a world-leading strategy for the mobilization of emerging technologies to make real and sustained contributions to life in the Far North.

There is no one ideal solution to the mobilization of science and technology to address issues of wellness, wellbeing, and happiness in the Arctic. What is clear is that the region has been acted upon, directly and indirectly, by the industrial world for generations, with not enough constructive and sustained contribution from northerners to the improvement of living conditions in the Arctic. This strategy would allow Arctic residents to define their technological future based on regional cultures and Arctic aspirations. It would challenge Arctic and non-Arctic nations alike to develop the best possible technological solutions for the North and, even more importantly, build innovation into the core of regional planning, governance, development, and education.

Technology is not a solution by itself. Technological innovation produces tools that careful planning and regional awareness can convert into the foundation for better lives, healthier people, strong communities, and a better, more suitable economy. Without guidance, however, technological change happens without foresight and without an appreciation for the full impact of the emerging scientific and technological realities. The Arctic needs a new path forward, one based on a real partnership with the peoples of the Arctic. But it also needs southern contributors, including those from non-Arctic states, to step forward in new and innovative ways, led by the peoples of the Arctic and focused on the co-creation of a new technological foundation for life in the Far North.

Notes

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Commentary

Denise Michels

INTRODUCTION

The purpose of this commentary is to identify success stories in local adaptation to climate change and in the pursuit of opportunities to improve living conditions in communities impacted by the opening of the Arctic due to climate change.

GEOGRAPHIC AREA

Section 112 of the Arctic Research and Policy Act of 1984 (PL 101-609) defines the Arctic as "all United States and foreign territory north of the Arctic Circle and all United States territory north and west of the boundary formed by the Porcupine, Yukon and Kuskokwim Rivers; all contiguous seas, including the Arctic Ocean, Beaufort, Bering and Chukchi Seas and the Aleutian Chains."

Alaska has three million lakes and forty-four thousand miles of tidal shore. The lands of Alaska are divided as follows: state ownership of 105 million acres, federal ownership of 237 million acres, and Alaska Native Regional Corporation and Alaska Native Village Corporation ownership of 44 million acres.

Following the discovery of oil on the Arctic coast in 1968, land ownership and native claims were extinguished under the 1971 Alaska Native Claims Settlement Act (ANCSA).[1] Initially, twelve regional for-profit corporations were formed. Later, a thirteenth regional for-profit corporation was added. The for-profits were created to allow Alaska Natives to become engaged in the capitalist system for resource and economic development. The thirteenth region was created for those shareholders who did not own land. Twelve regional nonprofit corporations were formed to provide health and social services within the same boundaries as the twelve regional for-profit corporations

The State of Alaska's title 29 allows for the creation of municipal governments in organized and unorganized boroughs (similar to counties in the rest of the US) to provide education, public works, and public safety for citizens within municipal boundaries.

In 1934, the federal Indian Reorganization Act (IRA) was enacted to reverse assimilation, establish sovereignty and self-government, and to build economic self-sufficiency among indigenous peoples. Tribes were federally recognized in each community in Alaska. Tribes have government-to-government relations with the US federal government, which has trust responsibilities to Alaska Natives. In Alaska, there is one reservation. There are multiple layers of government entities to navigate through in the state of Alaska that are unique within the United States.

OUR CULTURE AND SUBSISTENCE

Subsistence is our cultural and spiritual identity. Our traditions and values tie in with hunting, fishing, and gathering off the land and the sea, which provide us with the nutrition for living in the Arctic.

What Are the Most Important Characteristics of the Changes Occurring in Arctic Communities in Recent Decades?

Western and northern Alaska's rural communities are facing multiple challenges due to climate change. They have observed the physical changes to the ecosystem and are working on adaptation strategies. One of the most prominent impacts of climate change is unpredictable weather causing the Arctic ice pack to melt, the ocean to be open longer in the winter season, stronger and more frequent storms leading to flooding and erosion, variation in the depth and movement sea ice, melting of the permafrost, changes in lakes, shifts in flora and fauna, and introduction of invasive species.

Negative effects of climate change, including the lack of access to marine mammals, are making food security one of the top priorities for Alaska Natives. Kawerak, Inc., the Bering Strait Region's nonprofit, is a member of Inuit Circumpolar Council (ICC)-Alaska. ICC-Alaska has identified food security/insecurity as a priority. In recent years, Gambell, Savoonga, Wales, and Diomede, all communities in the Bering Strait Region of Alaska, have harvested walrus, a main staple of food, at levels far lower than in prior decades. As a result, the governor of Alaska has declared economic disasters for some of these communities. Meat racks that were once full of walrus and seal hanging to dry for winter storage are bare. ICC and Alaska Natives are working with nongovernmental organizations (NGOs) and state and federal agencies to identify baseline data to help develop policies and procedures based on science to allow Alaskan Natives to continue to engage in our cultural subsistence activities.

There are opportunities arising from the opening of the Arctic for renewable and nonrenewable resource development, including training, jobs, new business prospects, new trades (welders, divers, certified boat operators, marine pilots, etc.), and development of clean energy (geothermal, wind, and solar).

The State of Alaska[2] and the US federal government have created Arctic policies,[3] along with implementation plans, that complement each other. Both the state and the federal government need to invest in critical infrastructure to be players in the global community for Arctic development.

The Inuit Circumpolar Council is a Permanent Participant in the Arctic Council. ICC has adopted the "Kitigaaryuit Declaration" under which ICC-Alaska has created its five-year strategic plan. ICC-Alaska's projects are in food security and education. The food security technical report is currently undergoing final review by contributing authors. Through ICC-Alaska, "[t]he project held community meetings and gathered information from traditional knowledge holders to identify baselines needed to assess the vulnerabilities of food security. The project will contribute to our understanding of the pressures to traditional food resources and communities that are resulting from climate changes and increase human presence and development in the Arctic."[4]

ICC adopted the Circumpolar Inuit Declaration on Sovereignty in the Arctic in April 2009 and the Circumpolar Inuit Declaration on Resource Development Principles in Inuit Nunaat in 2011.[5] Kawerak, Inc. adopted a Resource Development Policy to guide departments in taking positions supporting or opposing development, while protecting subsistence resources and activities for future generations. Kawerak has created subsistence maps using traditional knowledge of the ocean currents in the Bering Strait and traditional seal and walrus hunting practices to aid in decision making.

How Have Communities Responded?

In 2007, former Alaska Governor Sarah Palin created the Climate Change

Subcabinet to develop recommendations for the state. In 2010, the state released a report on *Alaska's Climate Change Strategy: Addressing Impacts in Alaska*.[6] The report identified key impacts on public infrastructure and developed recommendations for infrastructure, revisions of existing policies, and other actions.

In Alaska, most communities include adaptation and mitigation measures in their local hazard mitigation plans (LHMPs).[7] The State of Alaska has reported that eighty communities have completed their LHMPs. Sea Grant Alaska provides an online *Alaska Climate Change Adaptation Planning Tool*. The following is from Alaska's Hazard Mitigation Plan:

> *Since the 1900s the City of Nome's business district and water front have been destroyed by fierce storms. The worst documented storms were in 1900, '02, '13, '45, and '46. The Nome seawall construction began 1949 and was completed in 1951. The seawall has saved Nome's Front Street and business district from further damage, until the 1974 storm.*[8] *Today the City Council has enacted zoning ordinances to mitigate further damage to comply with Flood Insurance Management Program.*

The US Army Corps of Engineers published, in 2009, a Baseline Erosion Assessment quantifying the average annual rate of erosion and modeling future erosion in communities. The report identified 178 coastal and river communities threatened by erosion, of which 26 were a priority and 8 were in peril. It also created an Immediate Action Work Group - a partnership between the State of Alaska's cabinet and the US Army Corps of Engineers - to develop a funding strategy to move projects forward. The assessment provided planning tools for communities for the development of mitigation strategies.

The community of Shishmaref, Alaska created the Shishmaref Erosion and Relocation Coalition through which local government, the native corporation, and the native village (under the Indian Reorganization Act) all reach out to agencies with a unified voice to identify plans for orderly relocation. They have identified key areas for relocation. The state of Alaska has conducted further reconnaissance for developing a rock quarry at Ear Mountain for road construction to the new site. The estimated cost to relocate the community is USD 180 million. The estimate to co-locate the community with Nome, Alaska is USD 93 million.[9]

The "Mertarvik: Strategic Management Plan for Community

Relocation" for the community of Newtok was created following severe erosion from a 1994 storm and continuing erosion caused by climate change. Newtok worked with the US Department of Defense Innovative Readiness Training Program to start construction at the new site named Mertarvik. The tribal council is striving to improve internal processes and communications to allow progress to continue.

The Alaska Native Tribal Health Consortium's (ASNTHC) Center for Climate and Health, in partnership with the US Environmental Protection Agency (EPA) and Western Alaska Landscape Conservation Cooperative (LCC), interviewed leaders of seven communities and published a report entitled *Climate Change in the Bering Strait Region*,[10] including recommendations for "Communities [to] revisit emergency plans regularly to evaluate new emergency threats"; "some communities to move above flood zone"; "integrate climate change projections into their engineering designs for new infrastructure"; and "[a]ll communities need good information so they can develop appropriate plans and continue the process of becoming more climate resilient." The conclusion notes that "a new climate is emerging characterized by thawing, opening water and longer warm season. These are signs of global change caused by the burning of fossil fuels and transfer of enormous quantities of carbon dioxide (CO2) from the land to the air. The changes affect all life. Bering Strait communities are awakening to a new climate future and are seeking adaptive strategies that encourage wellness and sustainability."

In regards to geopolitical successes, land-claims settlements with Alaska Natives have proven successful for well-managed corporations under ANCSA. Under the true spirit of sharing and taking care of each other, the Regional Corporations provide dividends to shareholders when they have successful fiscal years. Under ANCSA, Regional Native Corporations must share 70 percent of their resource revenues, identified as "7(i)" revenue, with the other twelve Regional Native Corporations. Regional Native Corporations are required to pass down half of the "7(i)" revenue to the village corporations and at-large shareholders within the regional corporations' boundaries. The village corporations, if financially healthy, provide dividends to village-corporation shareholders. Thus, there is a distinct difference between Alaskan Regional Native Corporations and typical western business corporations in their missions and shareholder strategies.

Overfishing of pollock in the Bering Sea waters almost depleted the pollock industry, leading to a closure of the fishery in 1992. Section 416 of the Coast Guard and Marine Transportation Act amended section 305(c) of the Magnuson-Stevens Fishery Conservation and Management Act to create Community Development Quotas, allocating 10 percent of the allowable catch of pollock in the Bering Sea and Aleutians to the communities. This has since been extended to other species and to Alaskan fisherman located to six fishing districts. The Norton Sound Economic Development Corporation (NSEDC) is the Bering Strait Region's nonprofit entity promoting economic development through training, education, and financial assistance. NSEDC's 2012 annual report provides the following information for the period 2006–10: USD 160 million in assets; 325 fisherman earned USD 3.25 million in payments; 325 scholarships gifted totaling USD 650 thousand; and 450 capital loans given for USD 4.5 million. NSEDC provides employment and community-benefit shares to give back to the communities so that communities can invest in infrastructure, lowering the cost of power for the region's residents.

Public Law 103-238 (section 119 of the Marine Mammal Protection Act as amended in 1994) allows the National Marine Fisheries Service (NMFS) and the US Fish and Wildlife Service to promote full and equal participation by Alaska Natives in decisions affecting subsistence management of marine mammals through a system of co-management. This has produced co-management agreements with the Alaska Beluga Whale Committee, Alaska Eskimo Walrus Committee, the Ice Seal Committee, and so forth. Many Alaska NGO's have requested the same type of co-management with the state of Alaska without success.

Public Law 93-638 (the Indian Self-Determination Education Assistance Act as amended in 1994) allows tribes to acquire increased control over the management of federal programs that impact their members, resources, and governments. The first step is for the tribe to contract for certain Bureau of Indian Affairs services successfully for three years with clean audits. This allows tribal consortiums to carve a path for their future by self-government allowing the tribes to create programs and allocate funds to met their tribal priorities. Kawerak's board of directors has identified Arctic shipping as a priority and allocated funds to create two positions to track state and federal initiatives, develop public comments to draft rules in the Federal Register, and to provide a "one-stop" person for the region to contact and communicate with regarding any policies, laws, and regulations being considered that would affect our subsistence way of life.

These are examples of self-determination and co-management opportunities that are successful in promoting prosperity and hope for the future.

The newly formed Arctic Waterways Safety Committee (AWSC), which along with the *Bering Strait Port Access Route Study and the Polar Code* are the legs of the three-legged stool for US Coast Guard Arctic policy, has drafted its workplan and Standards of Care for Operations. These provide all users a venue to discuss issues and allow all stakeholders to work together and avoid litigation that would tie up decisions for years. For example, during two weeks on board the US Coast Guard icebreaker *Healy*, together with the National Science Foundation's scientific team for the Arctic Ocean, we observed changes in the ice cap and the abundance of marine mammals and wildlife at the Hannah Shoal. I will recommend that the AWSC write to the International Maritime Organization (IMO) that ships be prohibited from dumping sewage in open water from one to five miles from the shoal when marine mammals are present.

Are There Feasible Changes in Public Policies or Institutional Arrangements that Would Improve the Ability of Arctic Communities to Deal with Changes?

The State of Alaska will consider pilot projects for co-management of fish and wildlife as a means of enhancing buy-in and ownership. If successful, they will become full co-management agreements similar to the federal co-management agreements.

It would help to support S.1273 entitled "Fixing America's Inequities with Revenue Act of 2013" (the FAIR Act of 2013) expanding outer continental shelf revenue sharing to Alaska. Currently, the Gulf of Mexico states are eligible but Alaska is not. There should be no mileage limit for OCS activities for communities that are directly impacted. For instance, Nome, Barrow, and Kotzebue may be over two hundred miles from leased areas but are directly impacted by vessel activities. St. Lawrence Island, where traffic passes on the US side, is impacted and bears the brunt the impacts of Arctic shipping and oil and gas activities in the Arctic but receives no benefits.

US Arctic policy for constructing an Arctic port in Alaska and the US Army Corps of Engineers (USACE) "HarborSim" program for calculating the cost-benefit ratio (CBR) of port development are not in sync. Because of the remoteness of Alaska and Alaska's low population, many USACE Alaska projects cannot pass the CBR test. Congress needs to be a global leader in the Arctic, investing in Arctic infrastructure for national security and national defense.

Many rural communities in Alaska have a high poverty rate and lack access to basic necessities, such as running water, sewer systems, and adequate housing. The high cost of transporting goods exacerbates the problem. As a start, providing funding to ensure that Arctic rural communities are on par with the rest of the nation in terms of infrastructure and basic necessities is essential. "Outsiders" who visit rural Alaskan communities for the first time have often compared conditions there to third-world countries.

Those who stand most at risk due to climate change should be considered in all economic-development opportunities created as responses to climate change.

Are There Opportunities for Outsiders, Associated with Both Non-Arctic States and Non-Arctic Actors, to Support the Efforts of Arctic Communities to Deal with Changes Successfully?

Investment opportunities are available for various infrastructure projects but financing mechanisms should be vetted by professional investors and underwriters. One avenue to consider involves the Denali Commission Act of 1988, which has a funding mechanism for public-private partnership to fund infrastructure. This mechanism has not been used to date.

The following list is a small sample of planned and proposed infrastructure projects in the US Arctic:[11]

- The Alaska gas pipeline projected construction cost is USD 45–60 million. Other wells, onshore support, and offshore structures are not included in this estimate. Nor is the cost for environmental assessments under the National Environmental Policy Act (NEPA).
- Seventy percent of communities have indoor plumbing; upgrades for existing systems are needed to address health threats; upgrades to benefit system operations and minor health threats are estimated at USD 1 billion.[12]
- Roads to Resources (i.e., the five hundred mile road to Nome) is estimated at USD 3 billion. The two hundred mile Ambler Mining

District Road will cost about USD 340 million depending on the route constructed. The one hundred mile road for Foothills West Transportation Access (road to Umiat for oil and gas) is estimated at USD 357 million.[13] The Kotzebue to Cape Blossom 11 mile road is estimated at USD 30 million.[14]

- Arctic Fibre plans to run fiber optics up the Northwest Passage to the North Slope and down the Bering Strait to connect Tokyo to London with an estimated cost at USD 1 billion. This would improve telemedicine services for rural Alaska and meet the needs for national security as identified in the US Department of Defense Arctic Strategy.[15]
- A Deep-Draft Arctic Port in Nome is estimated at USD 213 million. Infrastructure at Port Clarence Port is estimated at an average of USD 48 million;[16] Kotzebue Cape Blossom Port at USD 30 million.[17] Barrow's Port Authority has plans for constructing a port with a draft to 8 feet below mean lower low water (MLLW).[18]

The Arctic Economic Council (AEC) was created as an "independent organization that facilitates business to business activities with responsible economic development." The AEC seeks to establish a partnership with the Arctic Waterways Safety Committee to enhance port development, search and rescue capabilities as well as best practices guidelines for Arctic energy development. The Arctic Slope Regional Corporation, Northwest Arctic Native Association, and Bering Straits Native Corporation have created a joint venture to work on sustainable resource-development opportunities.

Globally, decision makers need to provide Alaskans the opportunity to prosper with Alaskan Natives at the decision table to contribute recommendations. The United States Agency for International Development (USAID) reported that "$1.5 billion was provided to Afghanistan to support democracy, rule of law and sustainable economic and social development responsive to citizens' needs."[19] Many Alaskan communities are considered to be living in third-world conditions and require US investment for the health and safety of their citizens. We recommend that the US invest in its own communities that are living in third-world conditions before sending US dollars to other countries. We realize this is a political statement and that many diplomatic missions rely on US aid.

US oil and gas companies are required to conduct work on leased tracts within a certain number of years. For Shell, the Bureau of Ocean Energy

Management (BOEM) and the US Army Corps of Engineers (USACE) placed time limits on travel to the lease tracts forcing exploration to take two years rather than one year. This allows disasters cased by human errors to happen twice instead of once. We recommend that the US government work with the Arctic Marine Mammal Coalition, who tracks the marine mammal migration, and industry to work on a timeline for safe exploration based on traditional knowledge with the changing climate, which is producing ice-free conditions later in the year.

I appreciate this opportunity held under the Chatham House Rule to allow free expression and dialogue so that ideas can flow. The global community and Inuit who live in the Arctic are in this together. We need to work together during this time of changes that impact all of us in one way or another.

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Commentary

Ellen Inga Turi

INTRODUCTION

Eegeesiak's article emphasizes two key messages. First, "the Arctic is not empty. Indigenous peoples have lived in this region for thousands of years. They have their own language, culture, systems of government, and livelihoods. They also have their own aspirations for their homelands and expectations about relationships with other parts of the world," urging newcomers to Arctic issues to not "overlook the people who live in the Arctic and minimize the importance of existing governance systems and local interests and priorities." Second, "Inuit are pragmatic and adaptable and we welcome partnership, cooperation, and collaboration with those who have recently become interested in the Arctic." But she cautions that "rather than suggesting to us [Inuit] how we should govern ourselves differently in the North, consider how your activities in the south are impacting us in the Arctic and make some adjustments closer to home."

This commentary supplements Eegeesiak's analysis with experiences from a Sámi perspective. I will start with some background on Sámi people, Sámi homeland, and livelihoods. I will then proceed to respond to the four questions posed in the terms of reference for this session: "What are the most important characteristics of the changes occurring in Arctic communities in recent decades?"; "How have these communities responded, and what can we identify as 'success stories' in this realm?"; "Are there feasible changes in public policies or institutional arrangements that would improve the ability of Arctic communities to deal with changes?"; and "Are there opportunities for outsiders, associated with both non-Arctic states and non-state actors, to support the efforts of Arctic communities to deal with changes successfully?" I conclude by highlighting opportunities for collaboration to take advantage of developments arising from ongoing Arctic change.

SÁPMI, SÁMI PEOPLE, AND SÁMI COMMUNITIES AND SÁMI LIVELIHOODS

The Sámi are the indigenous peoples of northern Europe. Our homeland, Sápmi, is located in northern Fenno-Scandinavia and on the Kola Peninsula. As such, we are a people residing in four nation states: Finland, Russia, Norway, and Sweden.

Key Sámi livelihoods include nomadic reindeer herding, fishing, and transhumance farming. While the majority of Sámi are today in more conventional or modern types of employment, our traditional livelihoods, including reindeer herding and fishing, remain central to our communities. The family-based character of these livelihoods also means that many retain strong relations to these livelihoods while earning their main incomes from elsewhere. As a result, while our traditional livelihoods do not represent the most economically important income source for the majority of our people, these livelihoods remain essential in terms of our retention of culture and identity.

As a people residing in four nation states, we have, by necessity, acquired experience with and knowledge in dealing with challenges internationally. The Saami Council, one of the Permanent Participants to the Arctic Council, was established in 1956. The primary aims of the Saami Council are to promote Sámi rights and interests in the four countries where the Sámi are living, to consolidate the feeling of affinity among the Sámi people, to attain recognition for the Sámi as a nation, and to maintain the economic, social, and cultural rights of the Sámi in the legislation of the four states.

While Sámi communities are separated by national borders, there are general commonalities in the living conditions in all our areas. First of all, and particularly in the Scandinavian side of Sápmi, we have good access to the basic healthcare and social welfare systems provided in nation states encompassing our homelands. As such, we are in a slightly different situation than that of many North American and Siberian indigenous peoples in the sense that access to adequate housing and social welfare is less of an issue for us. This is, perhaps, due more to geography than policy. There are no significant differences regarding access to housing, education, and healthcare between indigenous peoples and the main populations in the Sámi areas. There are, however, issues remaining to be resolved regarding access to culturally appropriate social care and healthcare, especially within the realm of mental healthcare.

THE MOST IMPORTANT CHARACTERISTICS OF THE CHANGES OCCURRING IN SÁPMI IN RECENT DECADES

Recent decades have seen profound changes, in both climate and socioeconomic terms, in our homeland, Sápmi.

Climate change is ongoing and easily noticeable in our homeland areas, posing requirements for adaptation for our traditional livelihoods such as reindeer herding and fishing. Sámi reindeer herders report increased variability and unpredictability in weather and timing of seasons. Sea Sámi are seeing new species, such as the king crab, entering our waters along with changes in movements of fish stocks.

Accompanying climate change is increasing economic and political interest in the Arctic. While climate change is generally perceived as a threat in southern latitudes, in the North it is often viewed simultaneously as an opportunity. Climate change is making Arctic areas more accessible for resource extraction, tourism, and shipping. As such, climate change represents a double challenge for Sami communities. As the climate is changing, we also are seeing increasing pressure on our land areas.

Allow me to elaborate: we are experiencing increasing economic interest in our homeland areas arising from natural resource extraction sectors such as the mining, oil, and gas industries, commercial fishing and accompanying infrastructure development. This has resulted in loss of access to land and increased pressures on our nature-based livelihoods.

In terms of land-use change, the following quote from a study conducted by the United Nations Environmental Program (UNEP) elaborates the challenge for reindeer herding:

> *Northern Scandinavia and parts of Russia are examples of areas where the current growth of infrastructure related to transportation, oil, gas and mineral extraction is increasingly incompatible with land requirements for reindeer husbandry. In these areas infrastructure growth is associated with the loss of traditional lands, and conditions forcing indigenous people to abandon nomadic herding patterns for more sedentary lifestyles. Infrastructure development is often concurrent with changes in regional economic activity inviting southern-based resource extraction companies interested in short-term economic gains. Such socio-economic changes not only affect cultural practices directly related to traditional reindeer*

> *husbandry, but also conflict with the use of traditional homelands for hunting, fishing and gathering. (Nellemann et al. 2001, 16–17)*

This study showed that 25 percent of reindeer pastures in northern Norway (which includes 35 percent of the coastal summer pastures and calving grounds of particular importance for nomadic reindeer herding) are "strongly disturbed" by development (Vistnes et al. 2009). Scenarios for 2050 estimate that the figure will increase to as much as 78 percent unless changes are made to national and regional plans (ibid.).

It is therefore not surprising that many reindeer herders are more concerned by land-use change than they are by climate change. Similarly, Sea Sámi fishermen highlight loss of rights to fish and access to markets as their main concerns.

HOW HAVE SÁMI PEOPLE AND LOCAL SÁMI COMMUNITIES RESPONDED AND CAN WE IDENTIFY SUCCESS STORIES IN THIS REALM?

Sámi people can be considered experts in adapting to climate variation. This is due to long-term experience with climate variability, whereby we have built resilience. Yet, the rate and magnitude of recent changes are presenting unprecedented challenges for our communities.

In particular, increased economic interest in natural resource extraction in the Arctic has resulted in several deep conflicts between local Sámi peoples and industrial, as well as state, actors. Over the past years, we have seen deep conflicts in areas opened for mining, windmills, and other developments. For example, recently we have experienced a boom in mining interests in our homeland areas, which has exposed key challenges in land-use governance in Sámi areas.

Such tensions are the result not only of renewed pressures on land use but also of inadequate governance structures and inadequate allowances for Sámi interests to be considered in the decision-making process. Thus, these types of conflicts expose key weaknesses in the governance of land-use change under which Sámi interests are not adequately accounted for in planning processes. Setting these challenges aside, however, it must be considered a success story that Sámi communities and livelihoods have been able to adapt to all such changes so far.

There are other positive aspects to this story. Recent years have seen an upsurge of Sámi community engagement in issues extending beyond local governance. We are witnessing an increase in active youth involvement and in interest in understanding and steering the types of changes we are witnessing.

WHAT ARE THE FEASIBLE CHANGES IN PUBLIC POLICIES THAT WOULD IMPROVE THE ABILITY OF COMMUNITIES TO DEAL WITH CHANGE?

Traditional knowledge represents a resource for the adaptation of livelihoods to change. Sámi traditional knowledge in reindeer herding and fishing is, by definition, accumulated knowledge for handling climatic variability successfully. Incorporating traditional knowledge into policy development and implementation is thus key to improving the capacity of communities to adapt to ongoing changes. Key challenges still remain.

Integrating traditional knowledge into policy development and policy implementation has proven challenging. Differences between the local and informal Sámi governance structures and the formal governance arrangements of nation states seem almost unresolvable. In a study (Turi and Keskitalo 2014) of reindeer-herding governance in Norway that I conducted together with Carina Keskitalo, we identified two main types of challenges in integrating traditional knowledge into governance as part of the policy-implementation process: utilizing traditional knowledge for environmental monitoring and utilizing traditional knowledge for institution building. In this specific case, challenges to integrating traditional knowledge result from the design of supportive policy instruments, where traditional knowledge is given lower priority than scientific knowledge and notions of rationality and practicality. Our study draws attention to the importance of considering the design of supportive policy instruments from a traditional knowledge perspective and, in particular, to asymmetrical power relations between ways of knowing.

Thus, changes in public policies that could support the ability of communities to adapt and handle these changes in a resilient manner would require greater attention to removing policy constraints on using traditional knowledge in livelihood adaptations. This requires initiatives, such as making efforts to include traditional knowledge during the policy-formation phase, at specific levels of policy development and implementation.

OPPORTUNITIES FOR OUTSIDERS, ASSOCIATED WITH BOTH NON-ARCTIC STATES AND NONGOVERNMENTAL ACTORS, TO SUPPORT THE EFFORTS OF ARCTIC COMMUNITIES TO DEAL WITH CHANGES SUCCESSFULLY

First, I want to emphasize that the Saami Council has a positive attitude regarding collaboration with non-Arctic states and nongovernmental organizations (NGOs) working toward better management of the challenges facing our areas. The framework of the Arctic Council has, so far, proven fruitful for such collaborations.

The Saami Council has adopted a pragmatic approach to such collaboration whereby we seek to engage directly (and independently) with relevant parties. For example, we have taken measures to engage in one-on-one dialogue with each of the observer states to the Arctic Council, following the standards of the council's rules on the participation of observers, to identify common interests and possible areas of collaboration.

The criteria for admitting observers to the Arctic Council, adopted by the Arctic Council ministerial meeting in Nuuk in 2011, address the relationship between Arctic indigenous peoples, or Permanent Participants, and the observers. In particular, the criteria require observers to the Arctic Council to:

- respect the values, interest, cultures, and traditions of Arctic indigenous peoples and other Arctic inhabitants;
- have demonstrated a political willingness, as well as financial ability, to contribute to the work of the permanent participants and other Arctic indigenous people; and
- have demonstrated a concrete interest and ability to support the work of the Arctic Council, including through partnerships with member states and permanent participants, in bringing Arctic concerns to global decision-making bodies.

The Saami Council has engaged with observer countries to open dialogue on how we can best collaborate to ensure successful outcomes for all parties. While this process is at an early stage, we believe that this type of engagement can facilitate fruitful collaboration between Sámi people and non-Arctic states by focusing on common spheres of interest and common goals for the future of the Arctic. This approach also recognizes the diversity of interests and capabilities of Arctic observer states in a manner that can ensure benefits for both parties. The Nuuk Observer Rules provide a general framework of reference to guide non-Arctic parties in their engagement in our homeland areas.

I want to emphasize that the Saami Council is, in general, positive toward the admittance of observer states and other bodies to the Arctic Council, and we welcome the establishment of forums for collaboration on Arctic issues. This is founded on our observation that Arctic issues can no longer be confined to the Arctic alone. To meet the challenges we are facing, not only in terms of climate change but also in terms of establishing frameworks to handle the increasing economic activities in the Arctic, it is no longer sufficient to think only regionally. Arctic issues are, by now, global issues. And the evolvement of these global issues requires global partnerships.

Commentary

Jong Deog Kim

NON-ARCTIC-STATE PERCEPTIONS OF THE ARCTIC

Headlines appearing after the Republic of Korea (hereinafter Korea) was admitted as an observer to the Arctic Council on 15 May 2013 spoke of "From a Frozen Sea to an Important New Shipping Route," "The Last Reserve, Providing a Path to Join in the Arctic Development," and "Amidst Scrambling for Arctic Resources and New Shipping Routes, Korea Obtains Observer Status." They are reflective of the interests of a country that had tried hard to obtain observer status since 2008.

Headlines these days speak of "Domestically Trained Marine Officer Participates in Northern Sea Route Expedition," "Signals of Climatic Change, and Long-Term Measures Needed for the Korean Peninsula," and "Trust and Capability, the Way Forward to Becoming the Best Arctic Partner." Expectations about economic opportunities in the Arctic are still there. But the issues covered are more diverse. The more balanced characterization of the Arctic in the Korean media is due perhaps to an increase in the diversity of information arising from expanded coverage of the activities of Korean experts.

I expect this trend to continue. This is particularly true of interactions with indigenous peoples, a matter of great importance to Arctic cooperation but a new endeavor for Korea. This will require engagement on the part of both the public sector and the private sector.

KOREA'S ECONOMIC RELATIONS WITH ARCTIC STATES

As of July 2015, Korea has entered into fifteen free trade agreements (FTAs) with fifty-four countries (see Figure VI.1) that account for over 74 percent of global gross domestic product (GDP). Korea has free trade agreements with all the Arctic states except Russia and with ten Arctic Council observer states. Thus, there is a solid basis for economic cooperation with Arctic Council members and observer states.

Figure VI.1 Countries with which Korea has Free Trade Agreements,[1] 2015

An examination of Korea's international trade reveals that 15 percent involves trade with the eight Arctic Council states (see Table VI.1) and that another 42 percent involves eleven Arctic Council observer states (see Table VI.2). Thus, countries linked to the Arctic Council constitute Korea's most important trade partners.

In addition, Korea has shipping agreements with twenty-three countries

Table VI.1 Korea's Trade with Arctic States, 2014[2] (USD)

States	Export	Import	Total
USA	70,284,872	45,283,254	115,568,126
CND	4,916,629	5,442,591	10,359,220
RUS	10,129,249	15,669,238	25,798,487
NOR	1,669,793	2,841,303	4,511,096
DEN	2,232,440	994,309	3,226,749
SWE	871,068	1,799,801	2,670,869
FIN	340,264	1,355,995	1,696,259
ICE	31,351	26,475	57,826
Sub total	90,475,666	73,412,966	163,888,632
Total	572,664,607	525,514,506	1,098,179,113

Table VI.2 *Korea's Trade with Observer States, 2014*[3] *(USD)*

States	Export	Import	Total
China	145,287,701	90,082,226	235,369,927
JAP	32,183,788	53,768,313	85,952,101
SGP	23,749,882	11,303,182	35,053,064
IND	12,782,490	5,274,668	18,057,158
UK	5,782,610	7,446,596	13,229,206
FRA	2,639,283	6,823,519	9,462,802
GER	7,570,926	21,298,750	28,869,676
ITA	3,473,076	6,260,922	9,733,998
NTL	5,296,459	4,605,487	9,901,946
POL	3,849,508	772,888	4,622,396
SPA	2,068,471	2,887,540	4,956,011
Sub total	244,684,194	210,524,091	455,208,285
Total	572,664,607	525,514,506	1,098,179,113

(see Figure VI.2), including four Arctic states: Denmark, Norway, Russia, and the United States. Korea also has shipping agreements with six Arctic Council observer states: China, Germany, India, the Netherlands, Singapore,

Figure VI.2 *Countries with which Korea has Shipping Agreements,*[4] *2015* and the United Kingdom.

Korea has agreements on scientific and technological cooperation with five Arctic states: Denmark, Finland, Russia, Sweden, and the United States and with eleven observer states, which makes sixteen out of the twenty countries (including Korea itself) associated with the Arctic Council.[5] In addition, the Korea Polar Research Institute established a research center together with the Norwegian Polar Institute in Tromsø in 2014.

KOREA AND THE ARCTIC COUNCIL

Korea was granted observer status in the Arctic Council (along with China, India, Italy, Japan, and Singapore) at the 2013 ministerial meeting in Kiruna, Sweden. In December 2013, the Korean government formulated its first "Arctic Policy Master Plan" with the goal of promoting systematic cooperation with the Arctic Council. Specific projects are being carried out in accordance with the plan's objectives, furthering cooperation in scientific fields, participating in sustainable businesses, and establishing domestic institutional bases for further Arctic activities.

This master plan is a compilation of individual Arctic projects begun, under different ministries, before the country was admitted to the Arctic Council as an observer. It also outlines ways to strengthen cooperation with Arctic Council partners (including subsidiary bodies and indigenous peoples' organization). An implementation plan was developed in April 2015 and is currently being carried out. The government intends to develop annual implementation plans to evaluate progress and to adjust the direction of the master to enhance cooperation with Arctic stakeholders.

ROLES AND RESPONSIBILITIES OF OBSERVERS IN THE ARCTIC COUNCIL

The Arctic Council's Rules of Procedure (RoP) and the Observer Manual for Subsidiary Bodies describe the roles and responsibilities of observers. In 2013, the council revised the rules and responsibilities in response to an increase in global interest in the Arctic and the need to manage relations with a group of observers consisting of thirty-two entities. Some of the key provisions of the revised Rules of Procedure include:

- Observer status shall continue for such time as consensus exists among Ministers. Any Observer that engages in such activities which are at odds with the Council's Declaration or these RoP shall have its status as an Observer suspended. . . . Observers are requested to submit to the Chairmanship not later than 120 days before a Ministerial meeting, up to date information about relevant activities and their contributions to the work of the Arctic Council should they wish to continue as an observer to the Council. Every four years, from the date of being granted Observer status, Observers should state affirmatively their continued interest in Observer status. Not later than 120 days before a Ministerial meeting where Observers will be reviewed, the Chairmanship shall circulate to the Arctic States and Permanent Participants a list of all accredited Observers and up-to-date information on their activities relevant to the work of the Arctic Council.
- The primary role of Observers is to observe the work of the Arctic Council. Observers contribute through their engagement in the Arctic Council primarily at the level of the Working Groups.
- Observers may propose projects through an Arctic State or a Permanent Participant but the total financial contributions from all Observers to any given project may not exceed the financing from Arctic State, unless otherwise decided by the SAOs.

The Observer Manual for Subsidiary Bodies includes detailed procedures and processes for observers regarding participation in the Arctic Council's activities. Key provisions include:

- Observers are encouraged to participate with their expertise, competence and resources primarily in the Working Group meetings and projects. Observers may not assign or designate another entity or organization to represent them at a meeting.
- The Chair of the Subsidiary Body in question should invite observers to the meeting. The Chair should send a final agenda to observers no later than 30 days before the specific meeting. Observers admitted to a meeting will have access to the documents available to Arctic states and Permanent Participant delegations, with the exception of documents designated as "restricted to Arctic States and Permanent Participants." The official report provided by the Chair or the relevant

Secretariat should be made available to observers after the meeting.
- Observers may, at the discretion of the Chair, make statements, present written statements, submit relevant documents and provide views on the issues under discussion.
- If an observer delegation does not respect the guidelines outlined in this manual, the Chair, after consulting with the Head of Delegations for the Arctic States and Permanent Participants, may ask the delegation to leave the meeting. The Chair will inform the Chair of SAOs accordingly.
- The priority of the Arctic Council Secretariat is to provide services to Arctic States and Permanent Participants. It may also assist observers in their participation by communicating information about meetings and other activities, distributing documents, as appropriate, and other assistance the Director decides to provide, in accordance with its ToRs.

The RoP and the manual recognize observer states as important Arctic Council partners and spell out their roles and range of participation. However, I the observers could contribute more to the work of the council if there were more specific processes dealing with their participation in projects, procedures for communicating up-to-date information, and opportunities for interactive with the secretariat.

KOREA AS AN OBSERVER STATE IN THE ARCTIC COUNCIL

Korea had already pursued various activities in the field of Arctic science before it became an Arctic Council observer states. In 2002, the Dasan Scientific Station was established in Svalbard; in 2009, the Araon, a research icebreaker, was built. These serve as Korea's main Arctic research facilities and conduct joint scientific research with various institutions in Canada, Norway, Russia, and the United States.

As part of the effort to enhance collaboration with Arctic Council's subsidiary bodies, the Korea Arctic Experts Network (KAEN) has been operating since 2014 to support Korean experts participation in the activities of the council's working groups and task forces and to share the outcomes meetings among domestic experts in relevant organizations. At present, fifteen organizations and forty experts are involved in the work of KAEN. The network is managed by the Ministry of Oceans and Fisheries and supported by the Korean Ministry of Foreign Affairs, with Korea Maritime Institute serving as coordinator.

Through KAEN, fourteen experts have participated in Arctic Council working group or task force meetings. KAEN will continue to help increase understanding of the Arctic Council and the Arctic region among Korean experts and policy-makers and seek ways to promote cooperation regarding common challenges. Additionally, interactions with experts from the Arctic are being expanded and academic and business exchanges strengthened by hosting sector-specific conferences in Korea.

Korea is now seeking opportunities for direct cooperation with the working groups of the Arctic Council. Working with the Working Group on the Conservation of Arctic Flora and Fauna (CAFF), for example, Korea hosted a meeting to discuss participation in the Arctic Migratory Birds Initiative (AMBI) project. Korea will continue to make efforts to increase cooperation between Korean experts and the CAFF secretariat. Also, major publications from various working groups are being translated into Korean and shared with relevant Korean education and research institutions.

SUGGESTIONS FOR ENGAGING WITH INDIGENOUS GROUPS

An important feature of the Arctic Council is the role accorded to indigenous peoples' organizations. Observer states, particularly Asian states, are becoming more aware of this fact and should respect it. Korea has no officially declared domestic indigenous groups, so engaging with autonomous indigenous groups in the Arctic presents new challenges. As Eegeesiak observes, we should understand the concerns and expectations indigenous groups have concerning the participation of outsiders in Arctic affairs. Observers need to support the efforts of indigenous peoples to protect their traditions and to respect their current rights. Based on these understandings, I believe a cautious but fruitful and cooperative relationship can be established.

The nine principles presented in "A Meaningful and Principled Approach for Inuit Engaging Arctic Council Observers" will serve as an important baseline for this effort. I hope that, in the process of acting on these principles, observer states will gain opportunities to understand more about the indigenous communities and their way of life.

I think Korea's "Arctic Academy," established by the Ministry of Oceans and Fisheries, and co-organized by UArctic and the Korea Maritime Institute in 2015, can provide an opportunity for young people from indigenous communities and Korea to share their visions and friendships. Sharing these principles between the two communities could become a regular theme for the academy. In this regard, I hope for more interest from the indigenous communities in this activity.

Although many observer states have allocated significant funds for Arctic research, more discussion is needed about how to utilize these research funds to address current Arctic challenges, including issues of high priority to indigenous peoples organizations.

Notes

1. www.customs.go.kr.
2. http://stat.kita.net/stat/cstat/peri/ctr/CtrTotalList.screen (July 2015).
3. http://stat.kita.net/stat/cstat/peri/ctr/CtrTotalList.screen (July 2015).
4. Korean Ministry of Foreign Affairs.
5. Korean Ministry of Foreign Affairs.

The Korea Maritime Institute (KMI) is a government-affiliated research organization under the umbrella of the National Research Council for Economics, Humanities and Social Science (NRC) in the Republic of Korea. Since its establishment in 1984, KMI has been a major think-tank in the development of national maritime and fisheries policies including shipping and logistics, port development, coastal and ocean management, maritime safety and security, and fisheries affairs.

The East-West Center (EWC) promotes better relations and understanding among the people and nations of the United States, Asia, and the Pacific through cooperative study, research, and dialogue. Established by the U.S. Congress in 1960, the Center serves as a resource for information and analysis on critical issues of common concern, bringing people together to exchange views, build expertise, and develop policy options.

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