

Climate Change and the Arctic: New Frontiers of National Security

Committee on Foreign Relations
U.S. House of Representatives

Wednesday, March 25, 2009 9:30 AM Rayburn 2172

An Overview of the Science and National Security Interests of Climate Change in the Arctic

The Arctic is now experiencing some of the most rapid and severe climate change on Earth. Over the next 100 years, climate change is expected to accelerate, contributing to major physical, ecological, social, and economic changes. Changes in the Arctic climate will also affect the rest of the world.

A Statement

by

Dr. Robert W. Corell

Vice President for Programs and Policy

The H. John Heinz III Center for Science, Economics and the Environment
and Chair of the Arctic Climate Impact Assessment

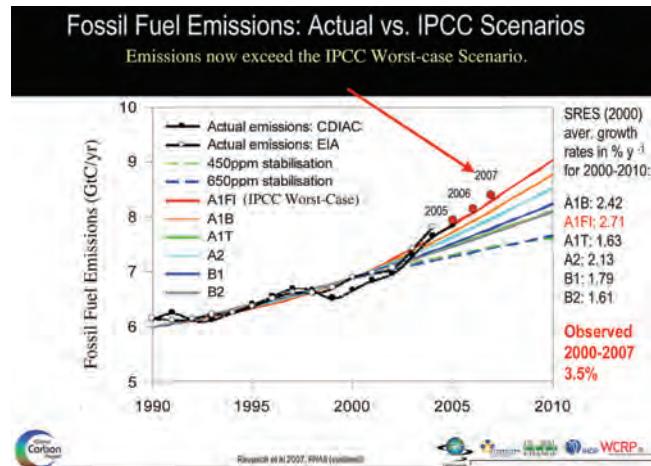
Introduction

Mr. Chairman, Members of the Committee, and all gathered here today, I thank you for the opportunity to participate in today's hearing to explore the implications of climate change in the arctic on our nation's national security interests, specifically U.S. territorial sovereignty, control of new waterways, access to natural resources, and environmental protection. I am honored to join you to report on recent developments in the science that underpins our understanding of the past and projected effects of climate change, especially in terms of the consequences within North America, across the Arctic region, and around the world. In offering these perspectives, I will be drawing from the findings of major scientific assessments and recent peer-reviewed publications that draw together the collective findings of the scientific community.

Context for Today's Hearing

The Intergovernmental Panel on Climate Change (IPCC's) Fourth Assessment Report¹ summarized the peer-reviewed scientific evidence that the Earth's climate continues to warm more rapidly and persistently than at any time since the beginning of civilization, in particular it concludes that:

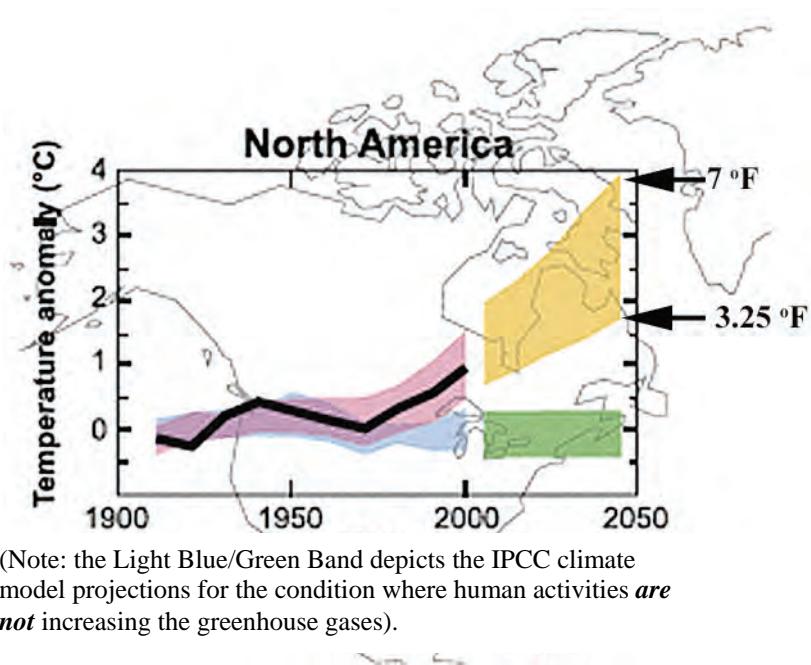
- Warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice and rising global average sea level,



¹ IPCC, 2007: Climate Change 2007: Working Group I Report "The Physical Science Basis see <http://www.ipcc.ch>.

- The atmospheric concentrations of CO₂ in 2005 exceed by far the natural range over the last 650,000 years. As depicted in this figure above, the 2007 fossil fuel emissions world-wide exceeded the “worst case” IPCC scenario (the top red line). The IPCC states that the global increases in CO₂ concentrations are due primarily to fossil fuel use, with land-use change providing another significant (20%) but smaller contribution.
- Most of the observed increase in global average temperatures since the mid-20th century is *very likely* due to the observed increase in anthropogenic GHG concentrations
- In the Arctic region, the main projected biophysical effects are reductions in thickness and extent of glaciers, ice sheets and sea ice, and changes in natural ecosystems with detrimental effects on many organisms including migratory birds, mammals and higher predators.

The overall temperature projections for the North American region is shown to the right in this 2007 IPCC figure which projects average temperature increases across the North American continent by 2050 from about 3.25 °F to 7 °F. This temperature increases for the Arctic region is likely to be about twice this or about 6.50 °F to 14 °F. While some of the fluctuations are likely a result of natural factors (e.g., variations in solar irradiance and major volcanic eruptions), the 2007 IPCC evaluation concluded that the strength and patterns of these changes makes clear that human influences will be responsible for most of the warming during the 21st century.



Patterns of Climate Change in the Arctic Region

There are three major changes in the Arctic region that will have profound consequences for the U.S. and the rest of the world, namely:

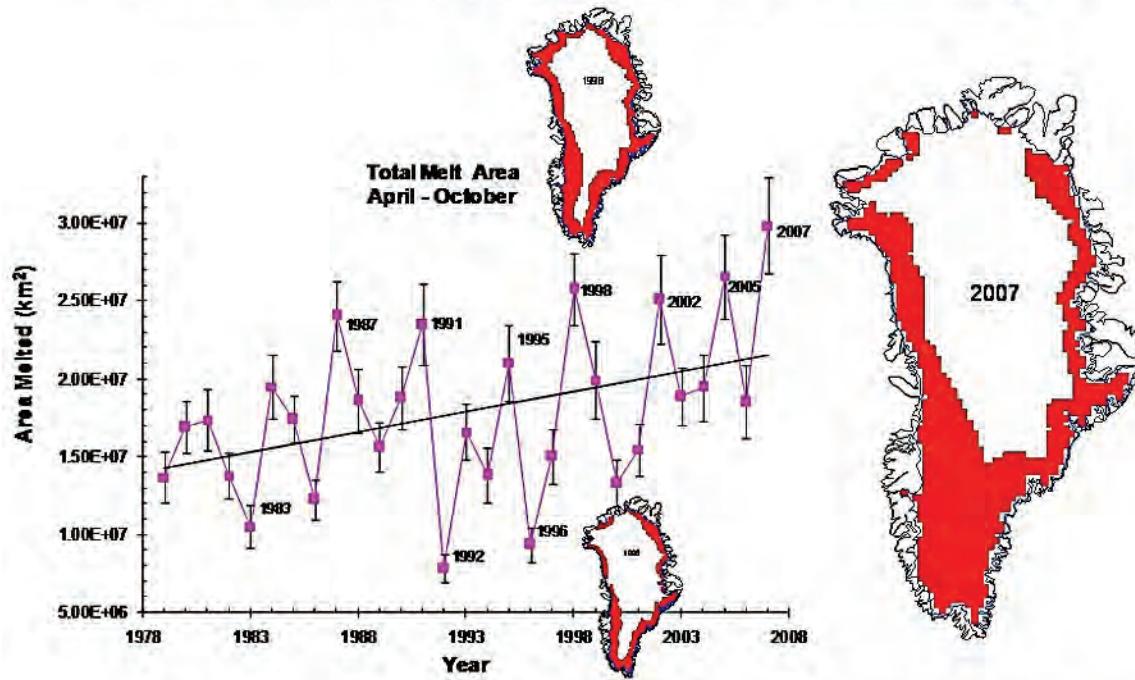
- Sea level rise from the melting of land based glaciers and ice sheets (e.g., Greenland) and continued warming of the world's oceans,
- Continued reductions of sea ice in the Arctic oceanic basin, and
- Changes in fisheries as a result of the warming of the oceanic waters into and within the Bering and Barents Seas.

Sea Level Rise: Sea level rise is the consequence of two factors, first the expansion of oceanic waters simply due to the warming of the water, which accounts for roughly half of the sea level rise since the beginning of the industrial period (i.e., late 18th and early 19th centuries), with the other half from the melting of land-based glaciers, such as Greenland. It is projected that land-based glaciers, particularly Greenland, will increasingly account for future sea level rise. Recent papers suggest that on the basis of calculations presented in this paper, it is projected that an improved estimate of the range of sea level rise

to 2100 including increased ice dynamics (i.e., melting of land-based glaciers) lies between 0.8 and 2.0 metersⁱ. The melting of Greenland is depicted in the graphic that follows.

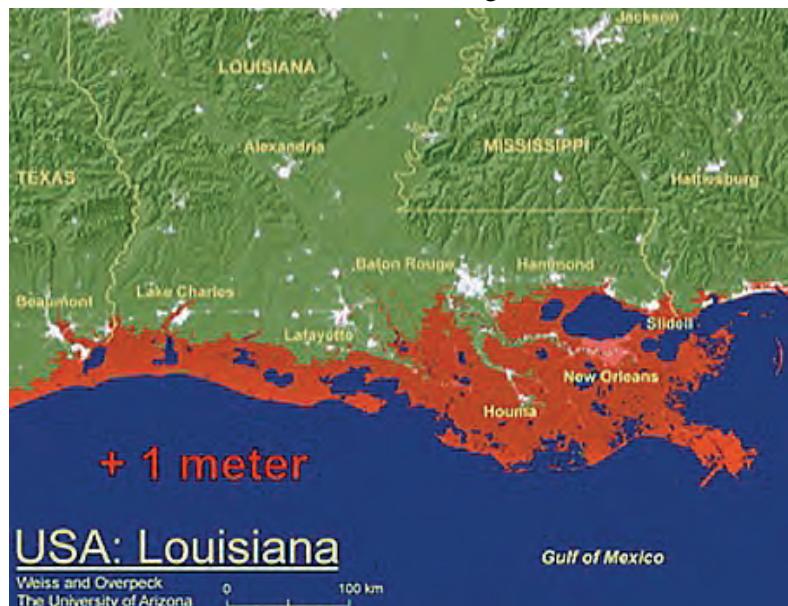
Greenland Total Melt Area

Melt extent for 2008 was above the 1979–2007 average



Source: Adapted from Steffen and Huff, CIRES, Univ.of Colorado

According to Nicholls and Leathermanⁱⁱ, a 1meter rise in sea-level would affect 6 million people in Egypt, with 12% to 15% of agricultural land lost, 13 million in Bangladesh, with 16% of national rice production lost, and 72 million in China and "tens of thousands" of hectares of agricultural land. The IPCC 2007 reports similar conclusions, noting that many "millions of people are projected to be flooded every year due to sea-level rise by the 2080s. Those densely populated and low-lying areas where adaptive capacity is relatively low, and which already face other challenges such as tropical storms or local coastal subsidence, are especially at risk." The impact of one meter of see level rise, which is currently emerging in the literature and the projection of many scientists, will have a profound on the U.S. in places like the New Orleans delta region. Similar impacts are expected and projected for low land countries

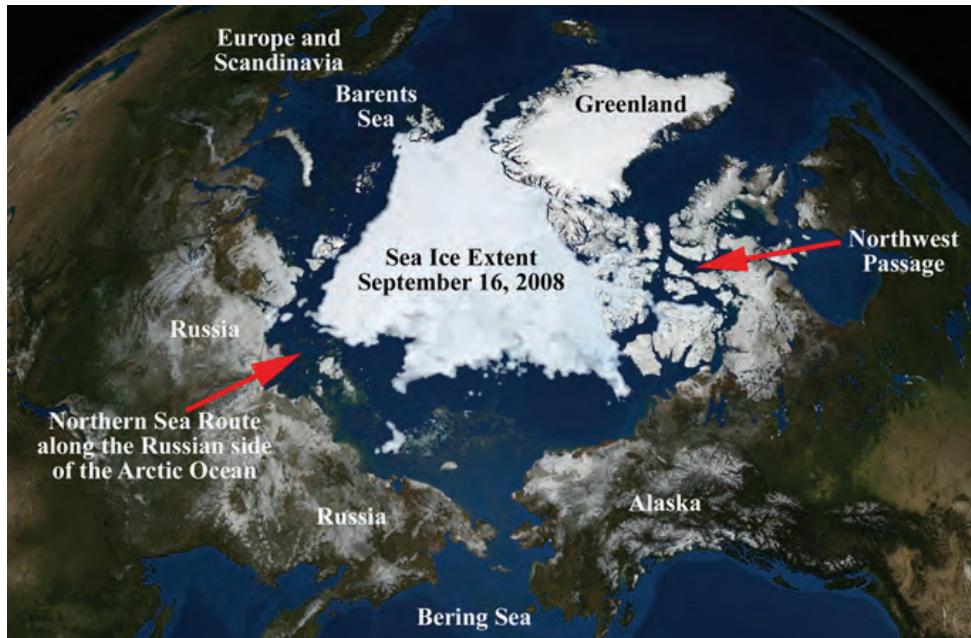
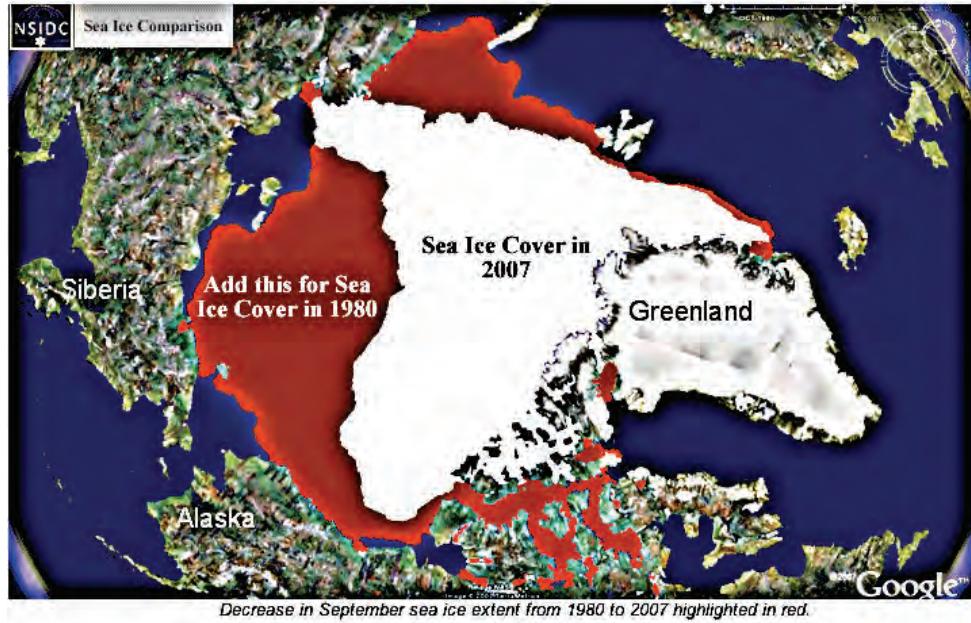


such as Bangladesh, other lowlands countries in Asian and the many small island states with little or no topographical relief (e.g., many with only a few meters maximum height). The consequences of these changes in sea level and related coastal changes during this century have important national security and environmental implications for our nation.

Reductions of Sea Ice in the Arctic Oceanic Basin: Reductions of areal extent of sea ice in the Arctic oceanic basin are substantial compared to past records, over 35 % since 1979. The National Snow and Ice Data Center and

NASA have tracked these changes by satellite since 1979. A longer time series of sea ice extent, derived primarily from operational sea ice charts produced by national ice centers, suggests that current September ice extent are over 50% lower than conditions in the 1950s to the 1970s (Stroeve et al.

NSIDC 2008). The 2008 areal extent of sea ice dramatically shows the opening of the seaways both along the Russian and Canadian coasts. The opening of these areas along these coasts not only opens navigation and shipping lanes, but also opens access to oil and gas development, new fishing grounds, and other natural resources development. It further complicates issues of territorial sovereignty, control of waterways, boundary delineation, and serious issues for indigenous peoples of the region,



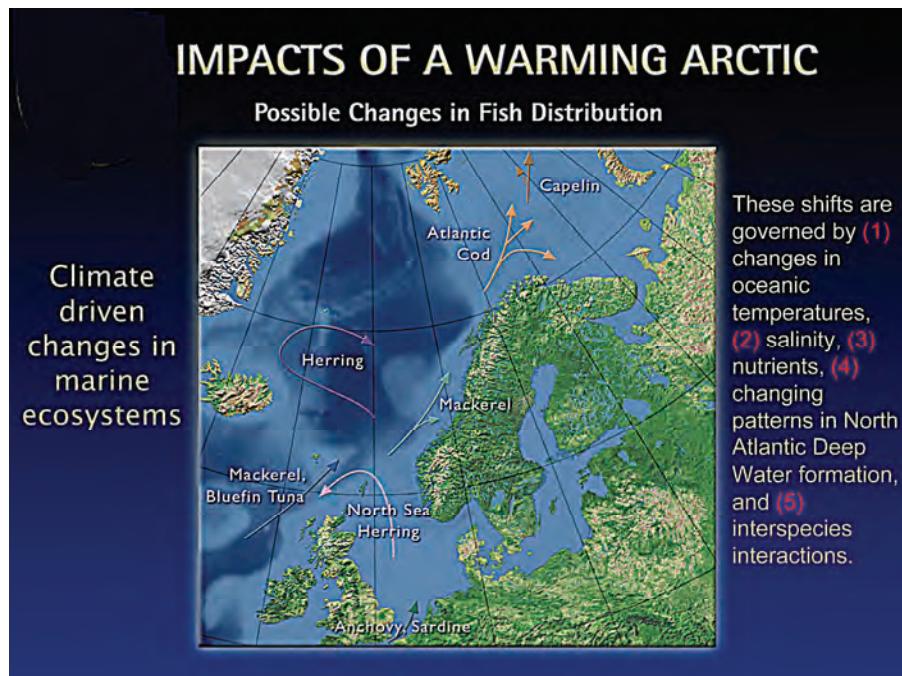
Changes in

Fisheries: Changes in fisheries as a result of the warming of the oceanic waters into and within the Bering and Barents Seas have been real and are increasing. The shifts in the Norwegian Sea and Barents

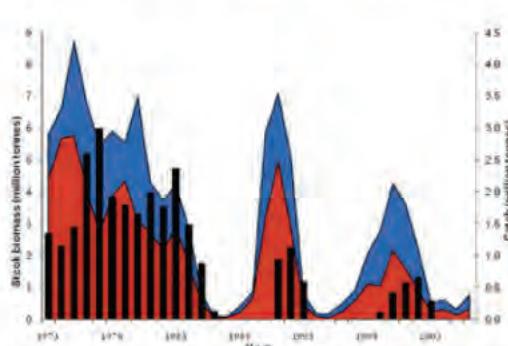
Sea are depicted at the right.

These shifts in the marine ecological structure leads to new fishing grounds, some of which are not under any fisheries regimes or agreements. The changes in the Cod/Capelin fishery are projected in the graphic to the right from the Arctic Climate Impact Assessment (2005) and are then depicted in the pair of graphics below.

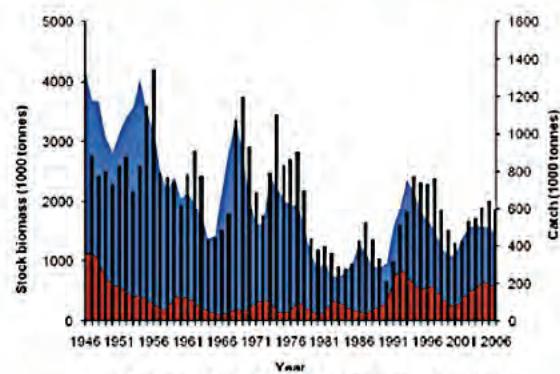
Such changes are likely to increase during the 21st century as warming of the oceans continue and the acidification of the oceans



A Comparison of the Reductions in Cod feedstock (Capelin) in the Barents Sea with the Concomitant Reductions in Northeast Arctic Cod



Barents Sea capelin. Total stock (blue area) and maturing component (red area) during autumn, and total landings (columns), 1973–2006. From PINRO/IMR report.



Northeast Arctic cod, development of spawning stock biomass (red area), total stock biomass (age 3 and older, blue area) and landings (columns). From PINRO/IMR report.

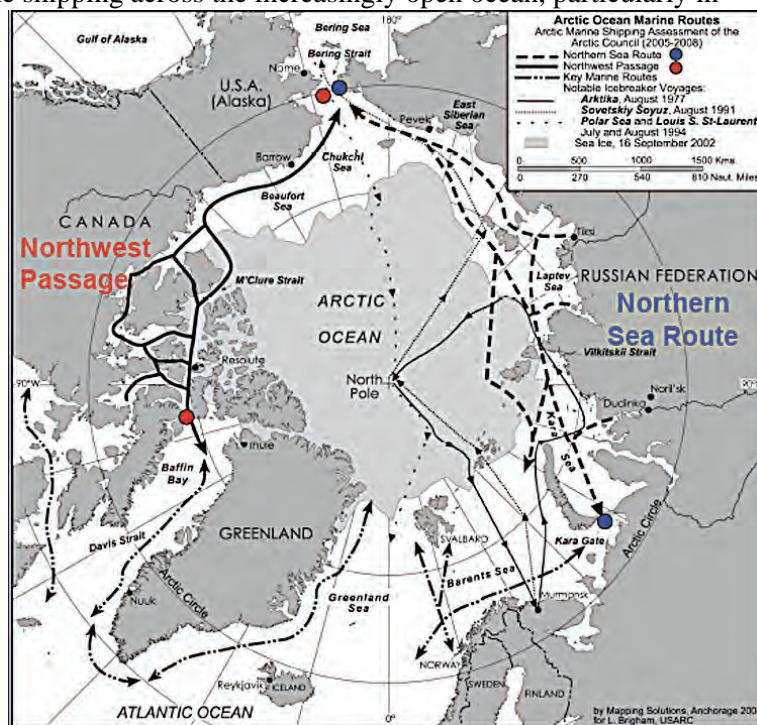
become more severe. The Fourth IPCC Assessment (2007) reports, with high confidence, that it is likely that there will be local extinctions of particular fish species at edges of their normal ranges with changes in their distribution and productivity. In particular with continued warming it also likely that there will be local extinctions at the edges of ranges, particularly in freshwater and diadromous species (e.g., salmon, sturgeon). It is projected in the IPCC Fourth Assessment (2007) that North Pacific oceanic ecosystems are likely to be characterized by ‘regime shifts’ (fairly abrupt changes in both physics and biology persisting for up to a decade). These changes have major consequences for the productivity and species composition of fisheries resources in the region. Major changes in Atlantic ecosystems can also be related to regional climate indicators, in particular the North Atlantic Oscillation (NAO), and therefore will have an impact on north-east Atlantic plankton, fish distribution and production. Production of fish stocks, such as cod in European waters, has been adversely affected since the 1960s by the positive trend in the NAO. Recruitment is more sensitive to climate variability when spawning biomass and population structure are

reduced. In order to reduce sensitivity to climate, stocks may need to be maintained at higher levels by fisheries management agreements. Climate-related reductions in production cause fish stocks to decline at previously sustainable levels of fishing; therefore the effects of climate must be correctly attributed and taken into account in fisheries management. The obvious consequence is a potential change in overall fish availability, and most particularly in the traditional availability of seafoods in lesser-developed regions of the world.

An Overview of Climate Change on National Security: One of the more important studies published in 2007 is the Center for Naval Analysis (CNA) “*National Security and the Threat of Climate Change*” report. This team of senior military officers concluded that “projected climate change poses a serious threat to America’s national security. The predicted effects of climate change over the coming decades include extreme weather events, drought, flooding, sea level rise, retreating glaciers, habitat shifts, and the increased spread of life-threatening diseases. These conditions have the potential to disrupt our way of life and to force changes in the way we keep ourselves safe and secure.” They further stated that “in the national and international security environment, climate change threatens to add new hostile and stressing factors. On the simplest level, it has the potential to create sustained natural and humanitarian disasters on a scale far beyond those we see today. The consequences will likely foster political instability where societal demands exceed the capacity of governments to cope.” To expand on these overarching perspectives, the remaining discussions in this testimony will focus on (i) the opening of the Arctic seaway to new opportunities and challenges in navigation and marine shipping, and (ii) a study underway to examine the governance issues in a rapidly changing Arctic.

The Implications of the Opening of the Arctic Seaways to Marine Shipping and Resource Development: A draft of the principal findings² of the Arctic Council’s Arctic Marine Shipping Assessment concludes that:

- Continued sea ice retreat will increase access
- Winter arctic sea ice cover will remain for the rest of the 21st century
- The primary driver for marine shipping across the increasingly open ocean, particularly in summer months, is regional & global natural resource development
- The primary sectors are: oil & gas, hard minerals, tourism, fishing and water,
- The global maritime industry are the key stakeholders,
- New ship technologies will allow greater access and independent operations (no icebreaker convoys needed),
- There is a serious lack of an integrated governance-regulatory framework,
- Minimal Arctic infrastructure is now

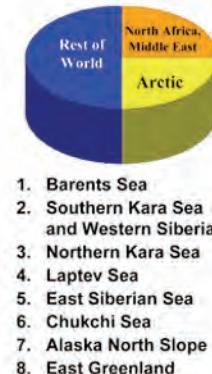


² The Report will be submitted to the Arctic Council at its 2009 Ministerial meeting in Tromsø, Norway in late April 2009.

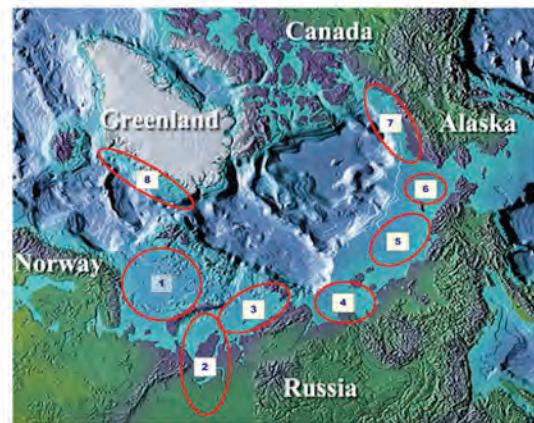
available to support expanded marine activity and provide adequate safety net,

- Greatly enhanced monitoring will be required,
- Intense development is most likely in the Northwest sectors of Russia and in the Norwegian-Barents-Kara Seas region,
- There is a need for balance to ensure freedom of navigation, coastal state marine safety, and environmental protection interests, and most importantly,
- There is a lack of Arctic experienced mariners from ship captains to seamen.

From a national security perspective, the opening of the seaways leads a series of geopolitical issues that are currently unresolved and will require thoughtful policy and international attention:



World's Petroleum Potential



- **Access:** Issues of Access and Rights of Passage through the Northern Sea Route (Russia) and the Northwest Passage (Canada).
- **Seaward Claims:** Claims of seaward ownership within the Arctic oceanic basin. Median Line Method (i.e., Divide into areas proportional to the amount of coastline of a country), and the Sector Method (Divide into areas by essentially longitudinal line from the countries to the pole). The seaward claims issue is of critical importance as it defines mineral, oil and gas, and fisheries rights. Given that most of the petroleum reserve potential is within the Russian coastal margins, these issues are as vital as marine seaway access.
- **Maritime claims and boundary issues:** Issues involving claims to jurisdiction over areas beyond the territorial sea within the Arctic oceanic basin (including claims under the provisions of UNCLOS Art. 76 to continental shelves extending beyond the limits of Exclusive Economic Zones) and the resolution of offshore boundary disputes.
- **Commercial shipping and oil and gas development:** Issues regarding the development of effective codes of conduct for shipping under Arctic conditions and for the conduct of offshore oil and gas drilling and production.
- **Arctic fisheries:** Issues concerning the management of northward moving commercial fisheries that takes into account the principles of ecosystem-based management.
- **Land claims:** Issues arising from longstanding use and occupancy and the still unresolved claims of a number of indigenous peoples as they relate to the governance of human-environment interactions in the Arctic.
- **Conservation of Arctic ecosystems:** Issues regarding the protection of marine and terrestrial ecosystems in the Arctic under pressure from human actions as well as biophysical changes.
- **Regional Governance:** Issues relating to multi-level governance and collaboration among regional, national, and international bodies in guiding northern development toward mutually desirable ends.
- **Venue:** Is the Law of the Sea the venue or will other international frameworks be sufficient to resolve these geopolitical issues?

A study to Examine the Governance Issues in a Rapidly Changing Arctic: Climate change -

coupled with the impacts of globalization - has triggered a cascade of events leading to profound environmental and socioeconomic changes in the Arctic and beyond. If anything, this cascade is accelerating. This, in turn, has generated a profusion of ideas about the need to restructure existing Arctic governance arrangements together with a range of concrete proposals for specific alternatives. This study, to be completed by Fall 2010, is designed to contribute to informed, timely, and effective policymaking that addresses the challenge of governance arising in conjunction with the impacts of rapid change in the Arctic. The study strategy is based on the following precepts:

- **Engage in an end-to-end process:** Engage members of the policy community at every stage in the study rather than simply presenting conclusions to policymakers after the analysis is completed.
- **Target all stages of the policy process:** Effectiveness depends on addressing the policy process at every stage from the framing of issues through the selection and implementation of specific policies to the stage of evaluation and assessment.
- **Address multiple policy windows:** Work with members of the policy community in multiple settings including gatherings of parliamentarians (e.g. the Standing Committee of Parliamentarians of the Arctic Region), officials representing governments in international settings (e.g. the Senior Arctic Officials in the Arctic Council), and representatives of sub national governments (e.g. participants in the activities of the Northern Forum) as well as agency personnel within the governments of individual Arctic states.
- **Choose Project team members with extensive Arctic experience.** Include individuals who have participated in the policy community themselves as well as individuals from the science community who have experience working in a variety of policy settings.

The study (The Heinz Center is a participant in this study) employs a three-stage strategy that is designed to facilitate policy considerations and development that address the challenges of governance in a rapidly changing Arctic.

Stage 1 - An Arctic Governance Compendium: Stage 1 will focus on assembling and sorting out the various ideas, suggestions, and proposals regarding Arctic governance that are pouring forth at this stage. This *Arctic Governance Compendium* will be prepared and posted on a continuously updated website. Project personnel will assemble this compendium in consultation not only with national officials but also the region's sub national governments, indigenous peoples organizations, and other key stakeholders. The compendium will include existing or newly developed materials from:

- The governments of the eight Arctic states³
- Sub-national Arctic governments
- Governments of non-Arctic states with ongoing interests in the Arctic
- The Arctic Council and/or its Subsidiary Bodies⁴
- The Indigenous Peoples Organizations of the Arctic region⁵
- Appropriate intergovernmental organizations, such as the Standing Committee of Parliamentarians of the Arctic Region
- Nongovernmental Organizations or Regional Entities with Established Arctic Programs and/or Interests (e.g. World Wildlife Fund)⁶

³ Canada, Denmark (including Greenland and the Faroe Islands), Finland, Iceland, Norway, Russian Federation, Sweden, and the United States of America

⁴ The Arctic Council is composed of the eight states listed above in footnote 4 and the six indigenous peoples organizations listed in footnote 6

⁵ Aleut International Association (AIA), Arctic Athabaskan Council (AAC), Gwich'in Council International (GCI), Inuit Circumpolar Council (ICC), Saami Council, Russian Arctic Indigenous Peoples of the North (RAIPON)

- Sectoral and/or Business/Industry Organizations⁷
- Colleges, Universities, and Individual Scholars.

Example of Arctic policy considerations that will be in the Compendium are the January 2009 U.S. Arctic Policy Statement (www.whitehouse.gov/news/releases/2009/01/print/20090112-3.html) issued by the President and the Ilulissat Declaration (www.oceanlaw.org/downloads/arctic/Ilulissat_Declaration.pdf), adopted by the Ministers of Foreign Affairs of Canada, Denmark, Norway, Russia, and the United States on May 28th, 2008. The declaration states that

The Arctic Ocean stands at the threshold of significant changes. Climate change and the melting of ice have a potential impact on vulnerable ecosystems, the livelihoods of local inhabitants and indigenous communities, and the potential exploitation of natural resources.

By virtue of their sovereignty, sovereign rights and jurisdiction in large areas of the Arctic Ocean the five coastal states are in a unique position to address these possibilities and challenges. In this regard, we recall that an extensive international legal framework applies to the Arctic Ocean as discussed between our representatives at the meeting in Oslo on 15 and 16 October 2007 at the level of senior officials. Notably, the law of the sea provides for important rights and obligations concerning the delineation of the outer limits of the continental shelf, the protection of the marine environment, including ice-covered areas, freedom of navigation, marine scientific research, and other uses of the sea. We remain committed to this legal framework and to the orderly settlement of any possible overlapping claims.

All the contributions to the Arctic Governance Compendium will be prepared and submitted by authors on their own behalf. The compendium will be “published” as a set of pdf files and updated as appropriate.

Stage 2 - Synthesis Workshop on Governance in a Rapidly Changing Arctic: Stage 2 will center on a Synthesis Workshop on Arctic Governance that seeks to identify a small set of critical questions relating to Arctic governance, to clarify the full range of perspectives and proposals regarding these questions, to determine areas where the development of consensus is possible, and to develop a set of key findings that can serve as a foundation for a *Synthesis Statement on Governance in a Rapidly Change Arctic*. This workshop will explore ways and means to ensure the engagement of Arctic residents - both indigenous and non-indigenous - in the discussions about governance systems. In cases where consensus is not possible, the workshop will focus on identifying the main points of disagreement and clarifying the options for dealing with them

Stage 3 - Dissemination of findings and engagement of the policy community: Once the findings of the Synthesis Workshop have been distilled and articulated in a clear and accessible way, Stage 3 of the project consists of a multi-dimensional communications strategy and implementation program to ensure that the findings are brought to bear in influencing policy. This third stage consists of the following elements:

- **An Overview Document:** Overview Document will be prepared that *articulates Key Findings and Issues regarding Governance in a Rapidly Changing Arctic* and publish it both in hardcopy and as a web-based pdf document. Following the models of the *Arctic Climate Impact Assessment (ACIA)*⁸ and the *Arctic Human Development Report (AHDR)*,⁹ the overview

⁶ World Wildlife Fund (WWF), The Northern Forum, Barents Region Council, Canada's Royal Commission on Aboriginal Peoples the Royal Commission, and others be determined by consultations with the Arctic Governance Partners and Collaborations

⁷ Clearly fisheries, oil and gas consortia, with the specific to be invited will be determined by consultations with the Arctic Governance Partners and Collaborations

⁸ See the ACIA Overview Document available at www.acia.uaf.edu

⁹ See AHDR available at www.svs.is/AHDR/

document will address the issues in simple and accessible language, devoid of complex terminology, with appropriate commanding graphics, and short in length. It will be widely accessible.

- **Policy Briefings:** Policy briefings will be held across the governance landscape in the Arctic from the Arctic Council to the organizations of the indigenous peoples of the Arctic to NGO's and business/industry groups. The purpose is not only to communicate our results to key people in the policy community, but also to *stimulate continuing discussions on the issue among stakeholders with the purpose of establishing a foundation for action* on issues of governance in a rapidly changing Arctic.
- **Publications in Scholarly and General Audience Literature:** An important contribution of the project will be to publish key findings in leading policy journals (e.g. *Foreign Affairs*, *Foreign Policy*), major newspapers as op-ed articles, and scientific journals (e.g. *Science*, *Nature*). as well as in appropriate electronic formats.

Summary: Climate change - coupled with the impacts of globalization - has triggered a cascade of policy considerations leading to profound national security issues, natural resources development and environmental protection consequences, and socioeconomic changes in the Arctic and beyond. If anything, this cascade is accelerating. This, in turn, has generated a profusion of ideas about the need to restructure governance arrangements together with a range of concrete proposals for specific alternatives. As noted earlier, the Arctic is now experiencing some of the most rapid and severe climate change on Earth. Over the next 100 years, climate change is expected to accelerate, contributing to major physical, ecological, social, and economic changes, which will also affect the rest of the world.

Greenland Icebergs at the entrance to the Ilulissat Icefjord



Thank you for this opportunity to testify at this hearing on “Climate Change and the Arctic: New Frontiers of National Security”

ⁱ Climatology: Threatened loss of the Greenland ice-sheet Jonathan M. Gregory, Philippe Huybrechts, and Sarah C. B. Raper, *Nature* **428**, 616 (8 April 2004) | doi:10.1038/428616a

ⁱⁱ Sea Level Rise: History and Consequences, By Bruce C. Douglas, Michael S. Kearney, Stephen P. Leatherman, Contributor Bruce C. Douglas, Michael S. Kearney, Stephen P. Leatherman, Published by Academic Press, 2001, ISBN 0122213459, 9780122213458, 232 pages