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The Integrated Arctic Corridors Framework

Planning for responsible shipping in Canada's Arctic waters

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Overview

Canada's Arctic Ocean encompasses more than 150,000 kilometres (92,000 miles) of coastline—from Baffin Bay in the east through the central Arctic Archipelago to the Mackenzie River delta in the west—connecting all four settled Inuit land claim territories and touching 53 northern communities. It provides habitat for the majority of the world's beluga and bowhead whales, narwhals, and polar bears and is a highway for some of the greatest marine mammal and seabird migrations on the planet.

Today, the world is looking to Canada's Arctic Ocean with dreams of faster and cheaper intercontinental shipping and the promise of unexploited natural resources. Climate change is creating a longer shipping season,[1] which has already resulted in vessel traffic increases of 166 percent since 2004 through the Canadian Northwest Passage. For decades, government departments, academics, and civil society groups have made recommendations for improving Canadian Arctic shipping policy; seven key government studies have issued more than 170 individual recommendations for reform. However, the nation lacks a clear, cohesive vision for Arctic shipping policy, so these recommendations have fallen on agencies with limited resources to carry them out.[2]

In 2012, the Canadian Coast Guard (CCG) began to address some of the systematic deficiencies in Canada's Arctic shipping policy by launching the Northern Marine Transportation Corridors Initiative (NMTCI). The initiative seeks to establish a system of voluntary marine corridors toward which the Coast Guard and other agencies could direct their financial, material, and human resource capacity to support vessel safety in the Arctic.[3] The NMTCI has the potential to be the foundation for a national Arctic shipping policy; but for this to happen, the corridor initiative must be widened to account for the environmental and social complexity of Canada's Arctic Ocean.[4]

The Canadian Coast Guard ship Louis S. St-Laurent trails the Coast Guard cutter Healy as the ships work their way north to study the Arctic Ocean floor in 2009.

To support the development of the NMTCI, The Pew Charitable Trusts conducted an analysis of the most recent shipping patterns in the Canadian Arctic Ocean, worked with shipping experts, and undertook a review of existing policy proposals to provide a road map to advance the Coast Guard's safety aims while expanding the approach to encompass environmental features and Inuit rights.

This report outlines the results of that research: the Integrated Arctic Corridors Framework, a policy designed to strengthen the NMTCI and balance calls for northern development with the strongest possible environmental protections and guarantees of rights for the region's people. The framework is based on the development of a system of shipping corridors that are classified into tiers according to assessed risk, addressing the gap in the current NMTCI model, which does not account for critical environmental and social variables.[5] In addition, the framework calls for a new management structure, the Canadian Arctic Corridors Commission, to govern this complex area.

The approach is based on the integration from the earliest stages of policymaking of the following three guiding principles that together will promote the interests and priorities of the government, Inuit, and the shipping industry:

1. Develop and adhere to world-leading standards for human and vessel safety in Arctic waters.
2. Establish comprehensive protection for the Arctic marine environment and its wildlife.
3. Fully and formally include Inuit in Arctic shipping policy creation and implementation.

(For more information, see Guiding Principles of the Integrated Arctic Corridors Framework on Page 7.)

The successful integration of these principles requires an approach based on the following key standards, which are applied throughout the Integrated Arctic Corridors Framework:

- Corridors should use targeted routing and site-specific management to reduce impacts on the marine environment by minimizing the overlap of shipping with sensitive marine areas.[6]
- Infrastructure development and contingency planning should match the level of assessed risk in each corridor, including worst-case scenario events (oil spills, vessel emergencies, etc.).
- Important Arctic passages (bottlenecks and other areas with particular environmental and social significance) require site-specific management strategies that account for their dynamic environmental and human importance.
- Formal marine protections need to accompany corridor development to ensure the biological abundance of the Arctic exists in perpetuity.
- Management of the network of Arctic shipping corridors should be an adaptive process, responding to environmental variability, new information, and monitoring.

If implemented within the NMTCI process, the framework's system of integrated, tiered corridors will benefit Canada, the shipping industry, and northern communities. The plan will help Canada improve human and vessel safety in Arctic waters, empower Inuit organizations to ensure that Arctic shipping enhances instead of threatens their long-term well-being, reduce risk to the environment, and give mariners the guidance and tools necessary to allow ships to travel the safest possible route. In this way, the framework would establish the NMTCI as the holistic, national policy that Canada needs to meet the challenges of next-generation Arctic shipping.

Narwhal in Eclipse Sound.

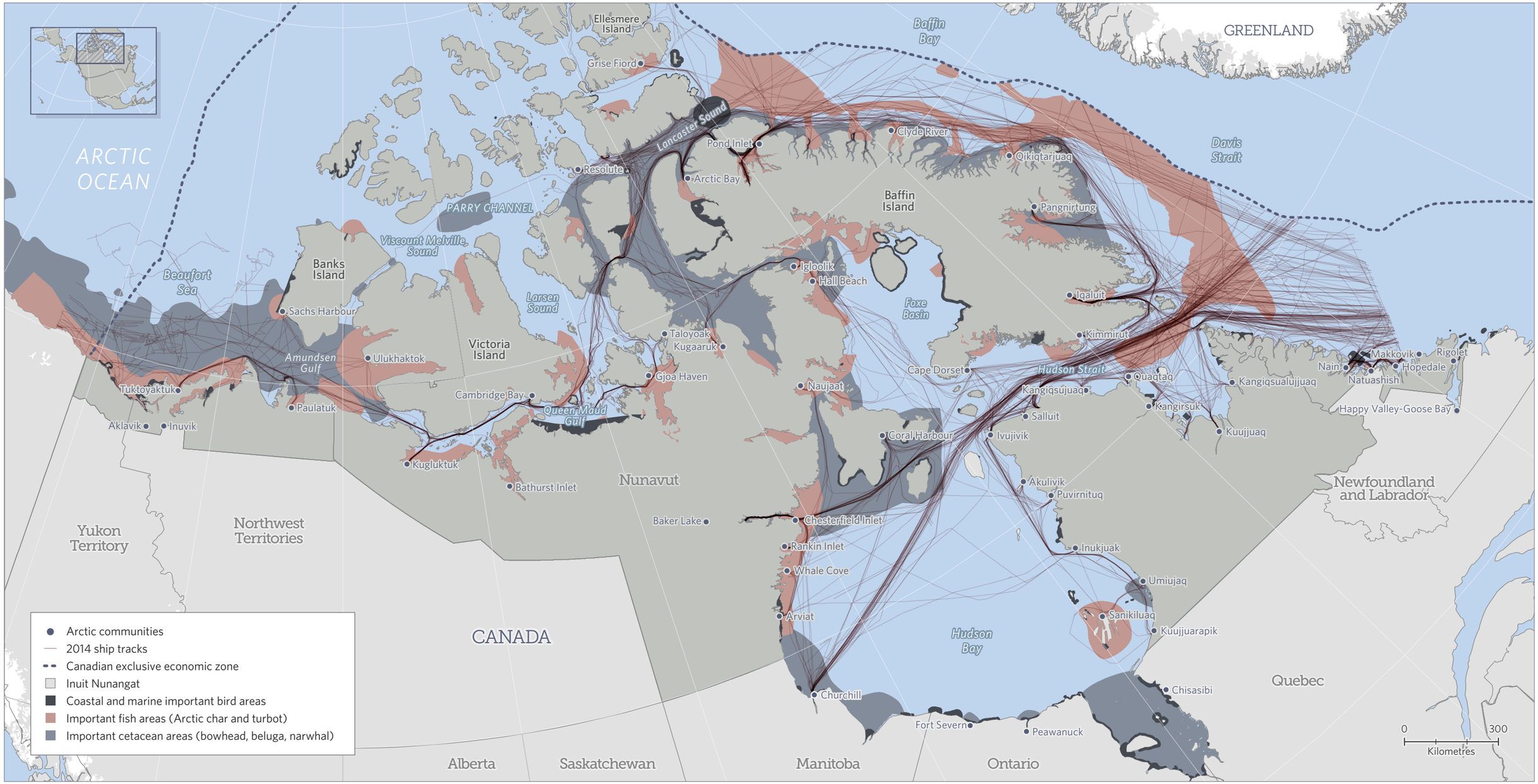
A complex marine environment

Ships travelling in the Canadian Arctic pass through a complex marine environment that comprises some of the region's most critical habitat areas, including many passages where the activities of birds, marine mammals, fish, humans, and ships converge during key seasons. (See Map 1.) The Integrated Arctic Corridors Framework brings together government departments, Inuit organizations, and other stakeholders to develop and manage a series of Arctic shipping corridors designed to achieve the highest possible level of human and vessel safety, environmental protection, and safeguarding of Inuit rights.

Map 1

Canada's Arctic Passageways Are Shared by Ships and Wildlife

Vessel, whale, fish, and bird movements



Sources: Important Bird Areas Canada, http://www.ibacanada.ca/explore_how.jsp?lang=EN; Fisheries and Oceans Canada, 2010 Arctic Marine Workshop, http://www.dfo-mpo.gc.ca/Library/341178.pdf; Bureau of Ocean Energy Management, *Satellite Tracking of Bowhead Whales* (2013), http://www.data.boem.gov/PI/PDFImages/ESPIS/5/5343.pdf; exactAIS Archive, Satellite AIS Data—Arctic, http://www.exactearth.com; Flanders Marine Institute, VLIZ Maritime Boundaries Geodatabase, accessed Sept. 4, 2015, http://www.marineregions.org

State of shipping through the Northwest Passage

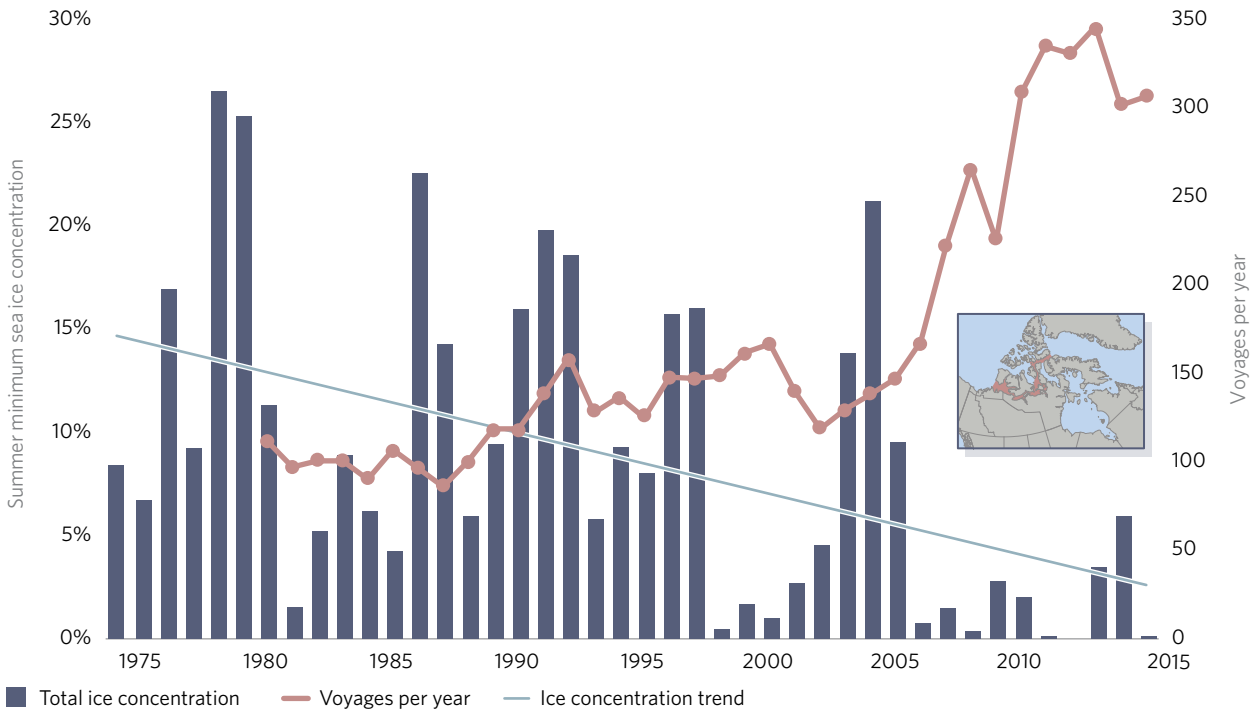
Over the past 10 years, the Canadian Arctic has experienced significant reductions in sea ice cover, while vessel traffic has more than doubled. (See Figure 1.) Ship passage throughout the Arctic is expected to continue to increase in the foreseeable future, motivated in part by predictions of ice-free summers in the Arctic Ocean as early as midcentury.[7] Some parts of the Arctic could see a doubling of current traffic levels by 2020.[8]

As Map 1 shows, Arctic shipping activity demonstrates a high degree of overlap among shipping patterns, Inuit-use areas and environmentally significant areas, especially at important passages, such as Lancaster Sound, Hudson Strait, and parts of the Canadian Beaufort Sea where seasonal oceanographic dynamics dramatically increase environmental sensitivity. In the coming years, Canada's Arctic waters could transform into a strategic maritime zone where global economic interests intersect with national sovereignty and security, environmental protection, and Inuit rights. Although, as noted above, the federal government has committed in principle to balancing Arctic development with these concerns,[9] its existing management of Arctic shipping does not sufficiently account for the environmental and social complexity of Canada's Arctic Ocean.

Figure 1

Arctic Vessel Traffic More Than Doubled as Sea Ice Retreated Over the Past 40 Years

Annual summer minimum sea ice concentration and number of vessel voyages, 1974-2015



Sources: Canadian Ice Service, Ice Graph application, http://iceweb1.cis.ec.gc.ca/IceGraph/page1.xhtml?lang=en; Canadian Coast Guard, "NORDREG 1980-2015 Shipping Summary" (Arctic vessel traffic data from Jean-Pierre Lehnert at Canadian Coast Guard Base Iqaluit, Nov. 7, 2015)

Guiding Principles of the Integrated Arctic Corridors Framework

The integration of human and vessel safety, Inuit rights, and environmental protection into a system of Arctic shipping corridors will provide Canada with a balanced and adaptable structure for managing Arctic shipping. Canada has already committed to forwarding the three principles in domestic legislation and international commitments.*

Develop and adhere to world-leading standards for human and vessel safety in Arctic waters

Canada has acknowledged the unique human and vessel safety challenges of Arctic shipping through its leadership in developing laws and agreements, including the International Code for Ships Operating in Polar Waters, the Agreement on Cooperation on Aeronautical and Maritime Search and Rescue in the Arctic, and the United Nations Convention on the Law of the Sea.

Climate change is creating new challenges for Arctic navigation. For example, although a climate change-related decline in sea ice is improving ship access, it will also result in increasingly hazardous multiyear ice floes, extreme ocean conditions, and more unpredictable weather.[†] Canada has not done enough to meet its goal of supporting human and vessel safety. In particular, Canada's Arctic waters are sparsely charted, supported by limited services, and lacking in essential infrastructure.

Establish comprehensive protection for the Arctic marine environment and its wildlife

Canada has long championed Arctic-specific environmental protections through the Arctic Waters Pollution Prevention Act (AWPPA),[‡] the Marine Liability Act, the Fisheries Act, the Canada Shipping Act, and the Convention on Biological Diversity. Government and Inuit organizations have identified nearly 50 percent of Canadian Arctic waters as ecologically and biologically significant.[§] Canada has pledged to protect 5 percent of its oceans by 2017 and 10 percent, including the Arctic, by 2020.[‖] However, less than 1 percent of the Arctic Ocean has been afforded any kind of formal protection.[#] Unmanaged shipping would put additional pressure on an Arctic marine ecosystem that is facing myriad climate change impacts, notably loss of ice habitat, ocean acidification, coastal erosion, and shifts in ecosystem structure.**

Fully and formally include Inuit in Arctic shipping policy creation and implementation

Canada is the world leader in recognizing the rights of its indigenous people. Four Inuit Settled Land Claims Agreements cover the entirety of Canada's Arctic and represent constitutionally protected rights that guarantee Inuit economic opportunities, the preservation of biological abundance for current and future generations, and social and cultural health for all of Inuit Nunangat.

Inuit are a maritime people who depend on the abundance of the marine environment for their culture and livelihood.[††] They can influence and manage shipping activities through land claims

Continued on the next page.

agreements, self-government agreements, advocacy for federal regulation and capacity building, and potentially by invoking international indigenous rights instruments.[‡‡] Inuit have advocated for strong shipping regulations that protect Arctic wildlife, prevent disruption to harvesting activities, provide tangible benefits to northern communities and support safe navigation.[§§]

* The Arctic Waters Pollution Prevention Act, the Convention on Biological Diversity, northern land claims, and several international shipping conventions administered by the International Maritime Organization (IMO).

† Larissa Pizzolato et al., "Changing Sea Ice Conditions and Marine Transportation Activity in Canadian Arctic Waters Between 1990 and 2012," *Climatic Change* 123, no. 2 (2014): 161–173, http://dx.doi.org/10.1007/s10584-013-1038-3; Laurence C. Smith and Scott R. Stephenson, "New Trans-Arctic Shipping Routes Navigable by Midcentury," *Proceedings of the National Academy of Sciences* 110, no. 13 (2013): E1191–E1195, http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3612651; Cecilie Mauritzen and Erik W. Kolstad, "The Arctic Ocean—An Ocean in Transition," Marine Transport in the High North, John Grue and Roy H. Gabrielsen, eds. (Oslo: The Norwegian Academy of Technological Sciences, 2011); Stephen E.L. Howell et al., "Multiyear Ice Replenishment in the Canadian Arctic Archipelago: 1997–2013," *Journal of Geophysical Research: Oceans* 120, no. 3 (2015): 1623–1637, doi:10.1002/2015JC010696.

‡ The Arctic Waters Pollution Prevention Act is intended to prevent pollution of all types in Canadian Arctic waters. The AWPPA states, "No person or ship shall deposit or permit the deposit of waste of any type in the Arctic waters." The AWPPA houses two sets of regulations: the Arctic Shipping Pollution Prevention Regulations (ASPPR) and the Arctic Waters Pollution Prevention Regulations (AWPPR).

§ Fisheries and Oceans Canada, "Identification of Ecologically and Biologically Significant Areas in the Canadian Arctic," Canadian Science Advisory Secretariat Science Advisory Report 2011/055, http://www.dfo-mpo.gc.ca/csas-sccs/Publications/SAR-AS/2011/2011_055-eng.pdf.

‖ Liberal Party of Canada, *A New Plan for a Strong Middle Class* (2015), https://www.liberal.ca/files/2015/10/New-plan-for-a-strong-middle-class.pdf.

Environment and Climate Change Canada, "Canadian Environmental Sustainability Indicators—Protected Areas, by Ecological Region," last modified Aug. 22, 2014, https://www.ec.gc.ca/indicateurs-indicators/default.asp?lang=en&n=A1570B00-1.

** Arctic Council, Arctic Marine Shipping Assessment 2009 Report, http://pame.is/images/03_Projects/AMSA/AMSA_2009_report/AMSA_2009_Report_2nd_print.pdf.

†† Inuit Circumpolar Council Canada (ICC Canada), The Sea Ice Is Our Highway: An Inuit Perspective on Transportation in the Arctic—A Contribution to the Arctic Marine Shipping Assessment (2008), http://www.inuitcircumpolar.com/uploads/3/0/5/4/30542564/20080423_iccamsa_finalpdfprint.pdf; ICC Canada, Circumpolar Inuit Response to Arctic Shipping: Workshop Proceedings (March 2013), http://www.inuitcircumpolar.com/uploads/3/0/5/4/30542564/201309121300arcticshippingscreenversion_revised.pdf.

‡‡ Any domestic, international, or private decisions that threaten the Arctic habitat would also threaten the Inuit people and should be subject to the international human rights concept of obtaining free, prior, and informed consent of Inuit peoples before proceeding. This indigenous human right was first codified in International Labour Organization 169 and has been reinforced in the 2007 United Nations Declaration on the Rights of Indigenous Peoples, to which Canada is a signatory. As such, challenging domestic projects or shipping activities on the basis that the operators, corporations, or governments failed to seek indigenous consent could be possible and presents more than adequate justification for future Arctic cruise operators, resource extractors, and others to engage Inuit communities or governments at the planning stage of shipping activities.

§§ Intergovernmental Panel on Climate Change, Climate Change 2014: Synthesis Report (Rajendra K. Pachauri, Leo Meyer, and The Core Writing Team, eds.), http://www.ipcc.ch/pdf/assessment-report/ar5/syr/SYR_AR5_FINAL_full.pdf.

The shortcomings of the management regime were propelled into the spotlight during the summer of 2010, when the MV Clipper Adventurer—a cruise ship with 128 tourists aboard—and the Nanny, a community resupply tanker carrying 9.5 million litres of diesel fuel, both ran aground in the Canadian Arctic Archipelago. These emergencies highlighted critical needs and areas for improvement in the management of Arctic shipping, including:

- The need for targeted routing and voyage planning.
- The need for critical equipment to support safe and responsible Arctic shipping.
- The importance of personnel certified and trained for Arctic-specific operating conditions.
- The significance of modern and operational communication systems.
- The hazards posed by inadequate charting.
- The importance of correctly using notices warning about local navigation hazards.
- The need for checks and balances on the master mariner's leadership in times of emergency.
- The risks posed to the Arctic ecosystem based on inefficient capacity to respond to an oil spill.[10]

The MV Clipper Adventurer and Nanny groundings demonstrated the risks associated with Arctic shipping, the complexities of managing shipping activities, and the pressing need for Arctic-specific policy reform. Over the past three decades, many government agencies, academics, and civil groups have recommended various improvements to minimize the likelihood and impact of such accidents.[11] (See Figure 2.)

The NMTCI offers the most promising foundation for the development of a national Arctic shipping policy. It already has identified primary (major well-known routes) and secondary (routes to communities) shipping corridors based on existing traffic patterns in conjunction with hydrographic information and proximity to Coast Guard services.[12] (See Map 2.) The Coast Guard's proposed corridors would significantly limit the area available for shipping activity and provide a strong starting point for integration.

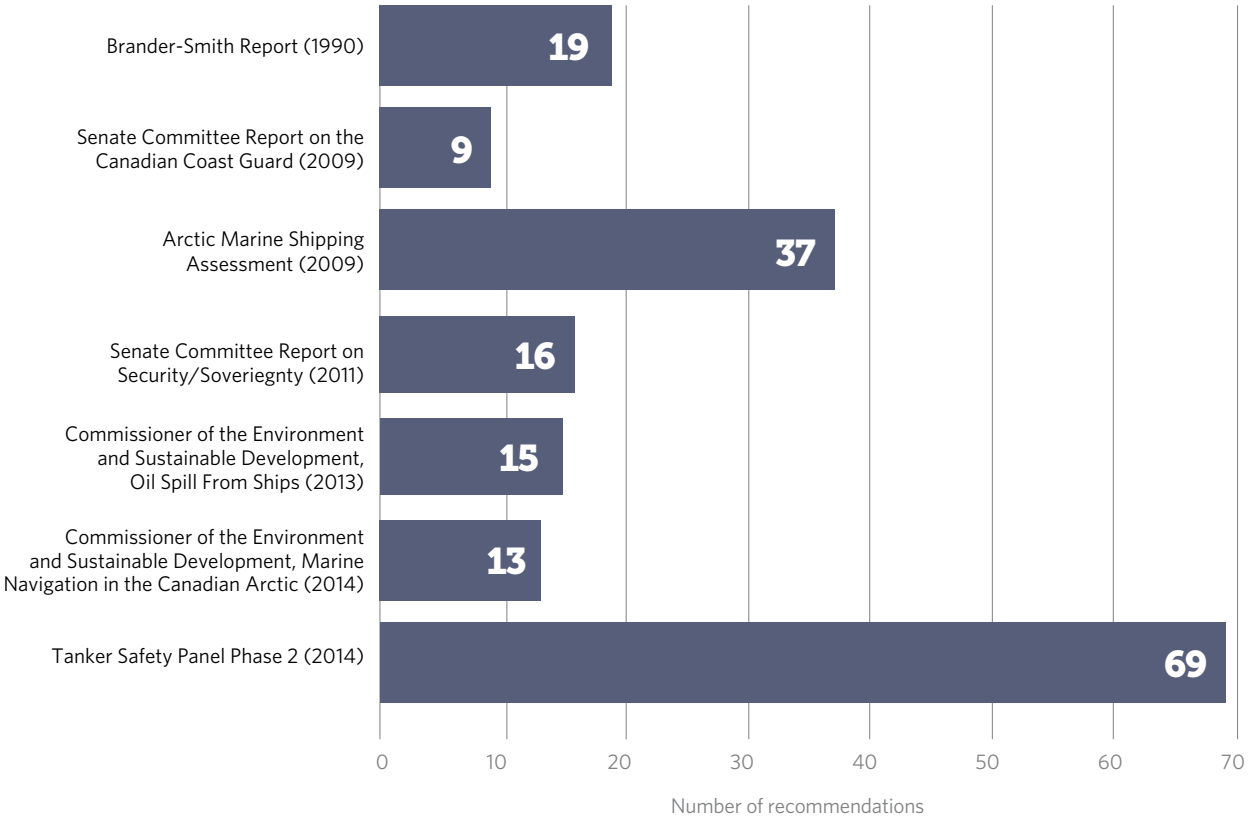
To become a complete Arctic-specific national shipping policy, the NMTCI must expand to account for environmentally significant areas and Inuit-use patterns. (See Maps 3 and 4.) The Oceans Act, which went into effect in 1996, requires the Department of Fisheries and Oceans Canada to designate ecologically and biologically significant areas across all Canadian marine areas. The process was designed to inform shipping management activities and the development of marine protections.[13] The large overlap of these areas with corridor designations illustrates the pressing need for greater study and integration of local environmental and Inuit-use information into corridor design. The Integrated Arctic Corridors Framework would address this gap—and, in doing so, would provide a more holistic approach to shipping management. (See Table 1.)

The framework was developed with an eye toward current shipping realities, the extent of anticipated growth in the industry, and the complex social, environmental, and economic issues at play. The next section details the framework and outlines a step-by-step process for its development.

Figure 2

7 Major Reports Include More Than 170 Recommendations for Arctic Shipping Reform

Numbers of recommendations

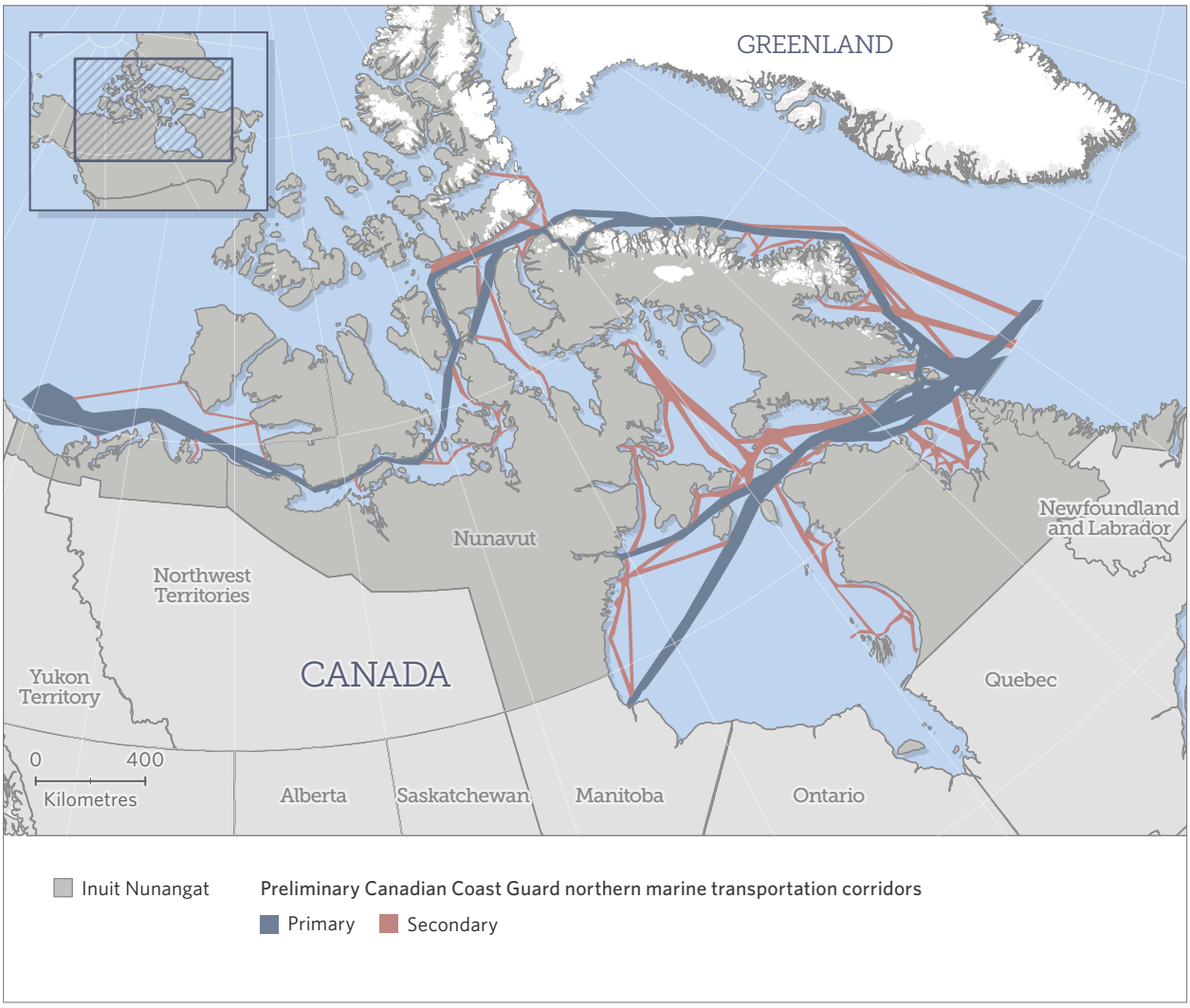


Sources: David Brander-Smith et al., *Protecting Our Waters*, Public Review Panel on Tanker Safety and Marine Spills Response Capability, Minister of Supply and Services Canada (September 1990), https://books.google.com/books/about/Protecting_our_waters.html?id=GTISAAAAYAAJ; Senate of Canada Standing Committee on Fisheries and Oceans, *Controlling Canada's Arctic Waters: Role of the Canadian Coast Guard* (December 2009), http://www.parl.gc.ca/content/sen/committee/402/fish/rep/rep07dec09-e.pdf; Arctic Council, *Arctic Marine Shipping Assessment 2009 Report*, http://pame.is/images/03_Projects/AMSA/AMSA_2009_report/AMSA_2009_Report_2nd_print.pdf; Senate of Canada Standing Committee on National Security and Defence, *Sovereignty and Security in Canada's Arctic* (March 2011), http://www.parl.gc.ca/Content/SEN/Committee/403/defe/rep/rep07mar11e.pdf; Office of the Auditor General of Canada, "Oil Spills From Ships," *2010 Fall Report of the Commissioner of the Environment and Sustainable Development*, http://www.oag-bvg.gc.ca/internet/English/parl_cesd_201012_01_e_34424.html; Office of the Auditor General of Canada, "Marine Navigation in the Canadian Arctic," *2014 Fall Report of the Commissioner of the Environment and Sustainable Development*, http://www.oag-bvg.gc.ca/internet/English/parl_cesd_201410_03_e_39850.html; Tanker Safety Panel Secretariat, *A Review of Canada's Ship-Source Spill Preparedness and Response: Setting the Course for the Future, Phase II—Requirements for the Arctic and for Hazardous and Noxious Substances Nationally*, Transport Canada (2014), https://www.tc.gc.ca/media/documents/mosprr/TC-Tanker-E-P2.pdf

Map 2

The Canadian Coast Guard Identified Arctic Shipping Corridors Based on Existing Traffic Patterns

Primary and secondary northern marine transportation corridors

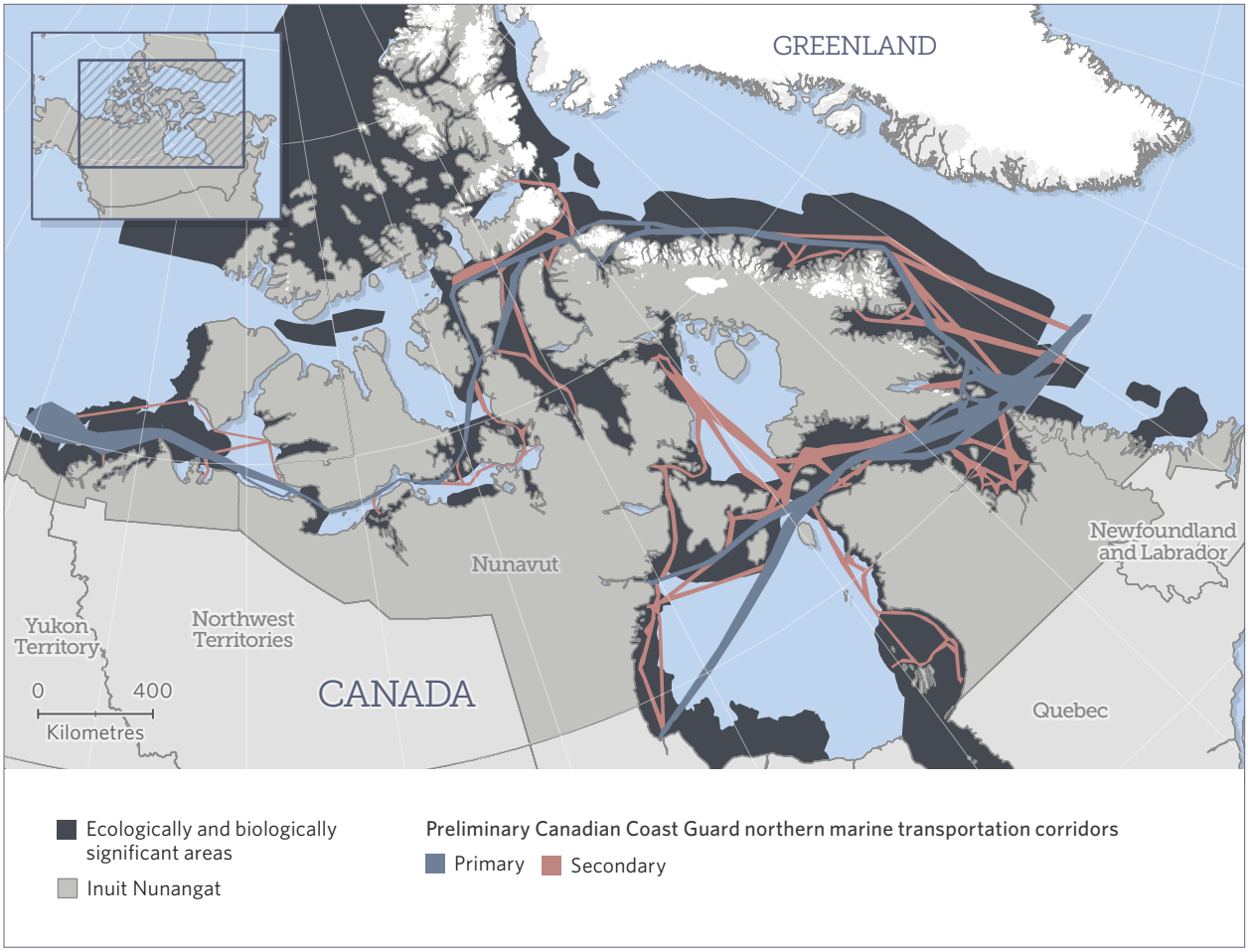


Source: Canadian Coast Guard, "Northern Marine Transportation Corridors Initiative," Company of Master Mariners of Canada, April 29, 2014, http://www.mastermariners.ca/maritimes/uploads/05marinecorridors.pdf

Map 3

Coast Guard Shipping Routes Overlap Extensively With Critical Arctic Habitat

Primary and secondary northern marine transportation corridors and designated ecologically and biologically significant areas



Sources: Canadian Coast Guard, "Northern Marine Transportation Corridors Initiative," Company of Master Mariners of Canada, April 29, 2014, http://www.mastermariners.ca/maritimes/uploads/05marinecorridors.pdf; Fisheries and Oceans Canada, "Identification of Ecologically and Biologically Significant Areas in the Canadian Arctic," Canadian Science Advisory Secretariat Science Advisory Report 2011/055, http://www.dfo-mpo.gc.ca/csas-sccs/Publications/SAR-AS/2011/2011_055-eng.pdf

Table 1

The Integrated Arctic Corridors Framework Adds to the Northern Marine Transportation Corridors Initiative

Additional policy values

Northern Marine Transportation Corridors Initiative	Integrated Arctic Corridors Framework
Corridors are based largely on current use patterns and marine safety, with limited consideration of environmental protection and Inuit rights.	Corridors are determined based on the integration of human and vessel safety, environmental protection, and Inuit rights.
The Canadian Coast Guard leads the initiative in partnership with Transport Canada and Environment Canada. To date, there has been no formal engagement with Inuit organizations.	The building and managing of corridors is led by a partnership between the federal government and Inuit organizations, in consultation with other stakeholders.
Corridor management does not reflect level of risk.	Corridors are managed using a tiered approach that matches risk with readiness.
Corridors are a pragmatic and strategic initiative but do not amount to a national policy.	Corridors are the foundation of a national shipping and marine policy for Canada.
Corridors are provided as voluntary guidelines for industry.	Corridors are integrated into new and ongoing regulatory reforms and initiatives.

Source: Oceans North Canada

Integrated corridors: Toward a national policy for Arctic shipping

The Integrated Arctic Corridors Framework brings all the key elements of Arctic shipping—prioritization and investment in infrastructure and service delivery, development and implementation of tailored shipping management measures, and strategic revisions to Canadian and international Arctic shipping regulation—into a single national policy. This comprehensive, integrated process will result in more informed decision-making and reduced risk for the shipping industry, Inuit communities, and Arctic ecosystems.

This section outlines the procedure by which integrated marine corridors should be built and managed. If implemented, the framework would establish an adaptive process whereby corridor designation, classification, and management could be revisited as the Arctic environment transforms, shipping patterns evolve, and new information is acquired through research and monitoring.

Building integrated Arctic corridors

Developing an integrated network of shipping routes in the Canadian Arctic must begin with a risk-based assessment that considers the key hydrographic, environmental, and social variables at play. Then a multi-stakeholder collaborative—the Canadian Arctic Corridors Commission—would establish a system of corridors through the lowest-risk regions identified in the risk assessment process. If done effectively, the system would substantially reduce shipping through the Canadian Arctic's most sensitive ecological areas, provide protection for Inuit traditional use, and deliver safe and practical choices for mariners. Environmentally or socially sensitive areas (including key Arctic passages) that cannot be excluded from shipping corridors should receive site-specific management plans.

Step 1: Create the Canadian Arctic Corridors Commission

The first step in implementing the framework is for the Canadian Coast Guard to establish a Canadian Arctic Corridors Commission, co-chaired by Inuit and the federal government and charged with developing a vision for Canadian Arctic shipping. The Canadian Senate already has recommended creation of such a body.[14]

The commission's mandate would have two phases. First, it would develop the integrated corridors. Then it would become the permanent management body responsible for overseeing the system, targeting resources, supporting safe and responsible vessel traffic, monitoring performance, and adapting to change.

Step 2: Consult and meaningfully engage Inuit

Building a national framework for Arctic shipping involves three key groups: the federal government, territorial governments, and Inuit organizations. Inuit must be engaged in the designation, classification and management of corridors that overlap with these areas in order to mitigate potential impacts to subsistence practices and user conflicts. Despite the federal government's special relationship with Inuit and notwithstanding requests from Inuit leaders to be involved in the development of a governance regime for Arctic shipping,[15] no formal mechanisms currently exist to engage Inuit on the issue. The first action of the commission, as it begins developing shipping routes, must be to fully and formally engage and consult with appropriate Inuit organizations. This will ensure that the framework is consistent with Canada's constitutional duty to "consult and accommodate" Inuit interests and provide a mechanism to capture Inuit priorities and empower Inuit to be represented in all phases of the framework's implementation.[16]

Inuit engagement is required by Canadian constitution and case law.[17] Beyond that, however, it benefits the framework effort by facilitating inclusion of local and traditional knowledge, enabling the identification of important habitat and Inuit-use areas, and providing linkages to Inuit organizations at the national, regional, and local levels, which are critical to corridor designation, classification, management, and monitoring. (See Map 4.)

Step 3: Integrate information

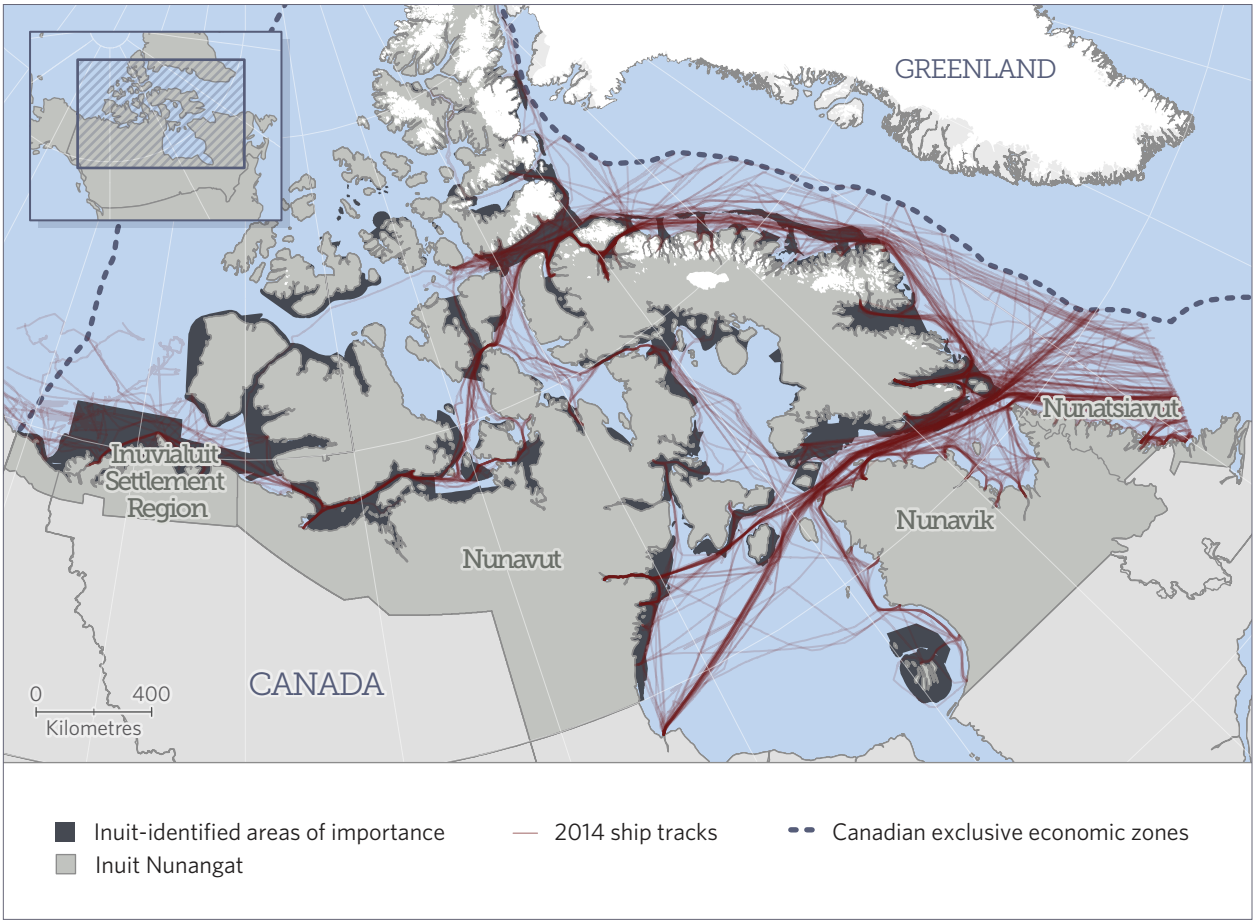
Shipping corridors are optimized when information on human and vessel safety, environmental protection, and Inuit knowledge and use is incorporated into the development process. This necessitates consultation, information gathering, and assessment to determine in which areas of the Arctic shipping would pose the least and greatest risk.

To account for the complexity of the region, the Canadian Arctic Corridors Commission would collate all available data into a single Arctic maritime atlas. This will allow the Coast Guard to identify and address information and planning gaps. The Coast Guard has started this data collection process, but its work has focused primarily on human and vessel safety without sufficiently considering other critical information and analyses. In particular,

Map 4

Canadian Arctic Shipping Traffic Intersects Many Inuit-Use Areas

Shipping patterns and identified Inuit areas of importance, 2014



Sources: exactAIS Archive, Satellite AIS Data—Arctic, http://www.exactearth.com; Nunavut Planning Commission, 2014 Draft Nunavut Land Use Plan (DNLUP) Spatial Data, http://www.nunavut.ca/en/downloads; Inuvialuit Settlement Region (ISR) Community Conservation Plan, http://jointsecretariat.ca/resources; Flanders Marine Institute, VLIZ Maritime Boundaries Geodatabase, accessed Sept. 4, 2015, http://www.marineregions.org

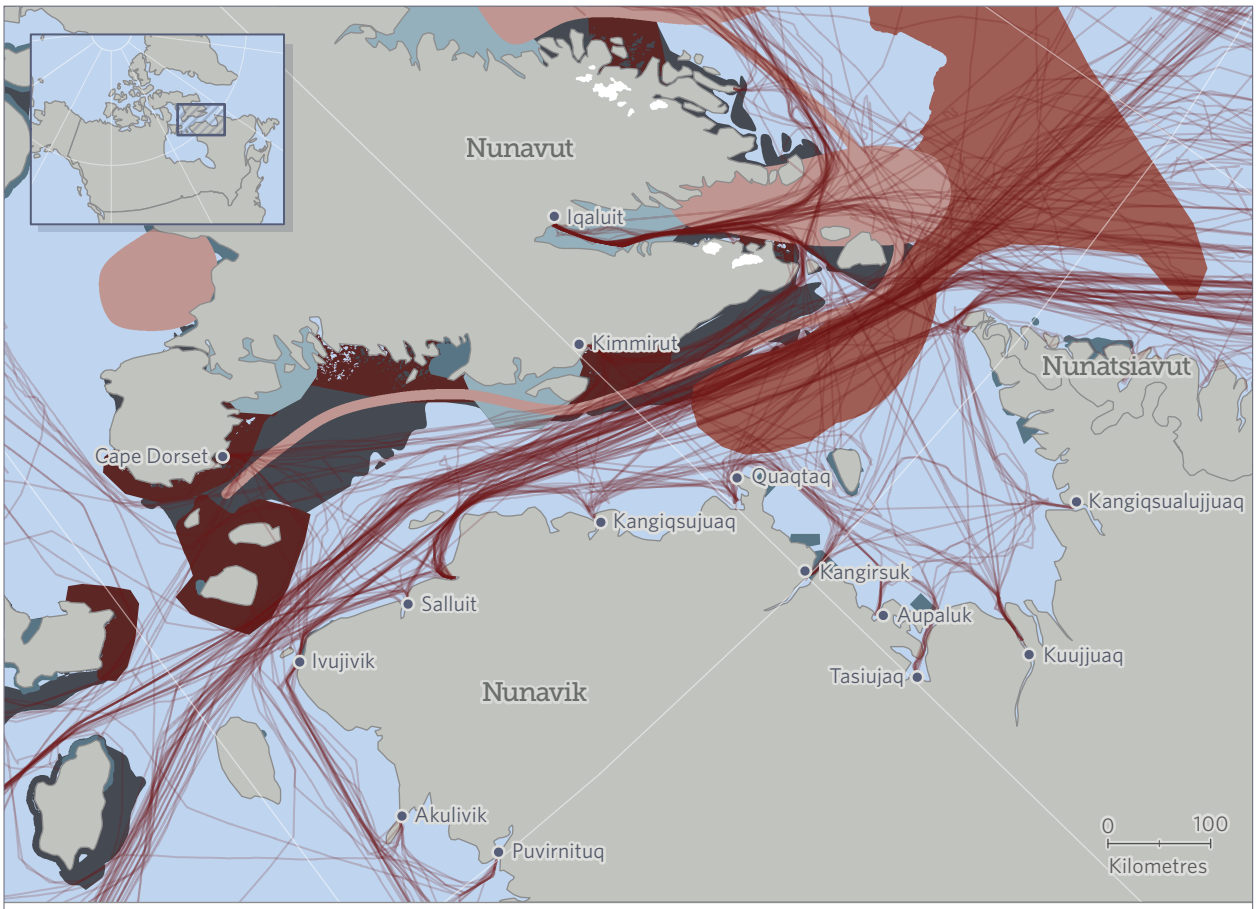
data on important Inuit hunting areas, community-identified conservation planning zones, wildlife migration routes, species-specific management plans, important cultural sites, and marine protected areas is available and should be included.

The degree of overlap between designated environmental areas and the Coast Guard's corridors—such as in the Hudson Strait, where vessel traffic, wildlife habitat, and Inuit activities intersect—demonstrates why such information needs to be considered in corridor design. (See Map 5.) Considering the full range of relevant information when developing corridors through Hudson Strait and similar regions of the Arctic will minimize this overlap by targeting routing, accounting for seasonal variability, and facilitating the creation of corridor-specific infrastructure.

Map 5

Hudson Strait Is Among the First Areas Where Ice Recedes in Early Summer and Is a Key Arctic Passage for Ships and Wildlife

Overlap of shipping activities with Inuit and biological designations



Sources: exactAIS Archive, Satellite AIS Data—Arctic, http://www.exactearth.com; Fisheries and Oceans Canada, 2010 Arctic Marine Workshop; Important Bird Areas Canada, http://www.ibacanada.ca/explore_how.jsp?lang=EN; Nunavut Planning Commission, 2014 DNLUP Spatial Data, http://www.nunavut.ca/en/downloads; ISR Community Conservation Plan, http://jointsecretariat.ca/resources; Charles G. Hannah, Frederic DuPont, and Michael Dunphy, "Polynyas and Tidal Currents in the Canadian Arctic Archipelago," *Arctic* 62, no. 1 (2009): 83–95, http://arctic.journalhosting.ucalgary.ca/arctic/index.php/arctic/article/view/115/149

Building integrated corridors also requires the collection of new information. Research on the overlap of important habitat features, migratory routes, and shipping activity is limited. Moreover, major gaps exist in the data on Arctic offshore ecology,[18] which is particularly relevant for shipping corridors and should be developed in partnership with outside research initiatives. Another critical need is to improve the federal government's understanding of oil spill sensitivity and response planning.[19] This information is especially important given that the eastern and western Arctic both have extended periods when spill response is not possible because of environmental conditions.[20] Transport Canada's Regional Response Plan for the Arctic is currently nonoperational and under review, but even if it were active, its local environmental sensitivity mapping and planning would be neither adequate nor complete.[21] The Canadian Arctic Corridors Commission could initiate studies to address these data gaps and support a fully informed corridor development and management process.

Step 4: Designate corridors

Based on the analysis of the full body of relevant information, a system of shipping corridors would then be selected. Through a multi-stakeholder process, shipping corridors through the Canadian Arctic would be identified and mapped. The process should also consider and incorporate the seasonal dynamics of the region, such as the timing of and areas used during migrations, calving, and rearing for marine mammals and molting for bird colonies.

Excluding environmentally and socially sensitive areas from corridors will limit impacts from shipping. Further, creating site-specific contingency planning for key hunting grounds and Inuit travel routes that intersect with corridors will minimize conflict and ensure the safety of subsistence harvesters. This is one of the greatest strengths of the integrated corridors approach. If all factors are balanced and considered holistically, vulnerable areas are protected and shipping occurs in a manner that enables the Coast Guard and other agencies to strategically allocate their resources.

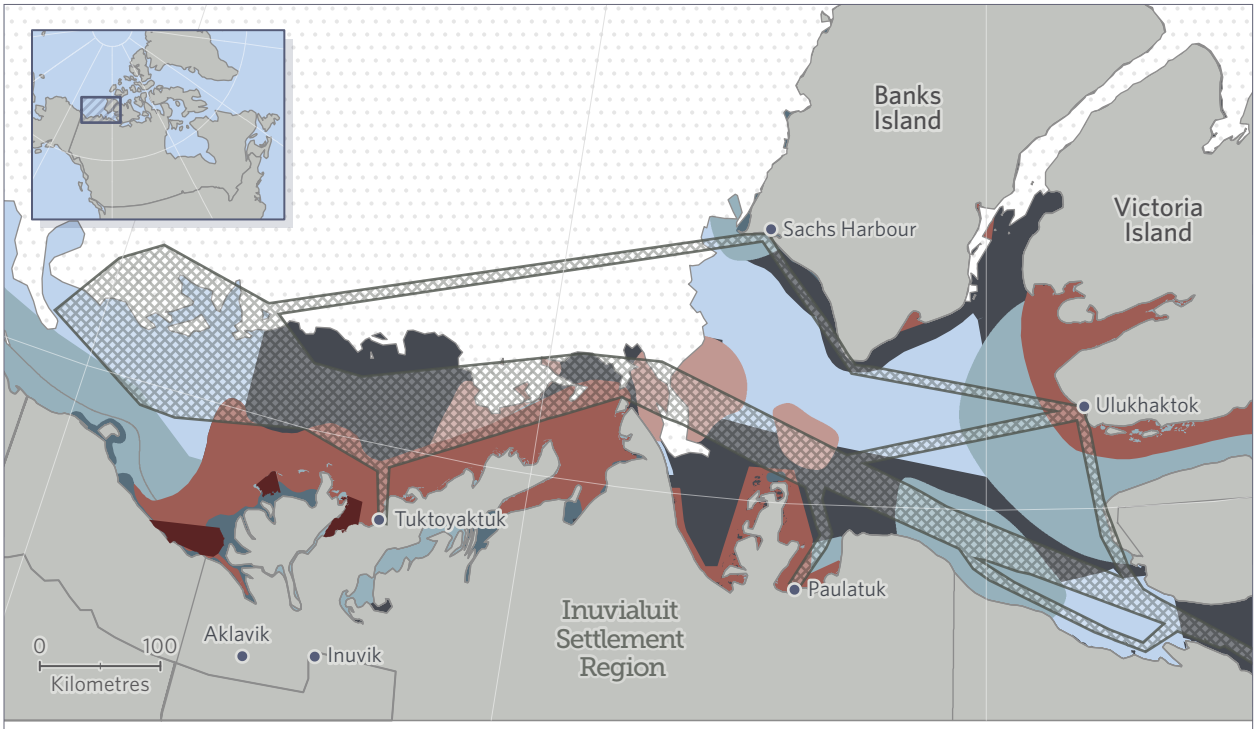
Key Arctic passages for wildlife, human activities, and shipping illustrate the need for further refinement of corridor designation. For example, the primary corridor through the Beaufort Sea is over 100 km (62 miles) wide at its widest point. (See Map 6.) To this point, the NMTCI has been largely based on the shipping activities that occurred for the three years from 2011 through 2013, creating the potential to formalize the industry footprint as a long-term shipping corridor. Existing information on the location of important ecological and Inuit areas have not been considered.

To ensure integration, the government must designate corridors that carefully and explicitly account for the needs of commercial shipping while excluding, to the degree possible, areas that are ecologically significant and important to Inuit. Comparing the Coast Guard's current Beaufort Sea corridor with one based on the integrated approach shows how targeted routing significantly reduces shipping's impact on environmental and Inuit-use areas while accounting for a higher percentage of the most recent vessel traffic. (See Map 7.)

Map 6

Shipping Corridors in the Beaufort Sea Overlap With Significant Environmental and Inuit Areas

Current Coast Guard routes and important areas, by type

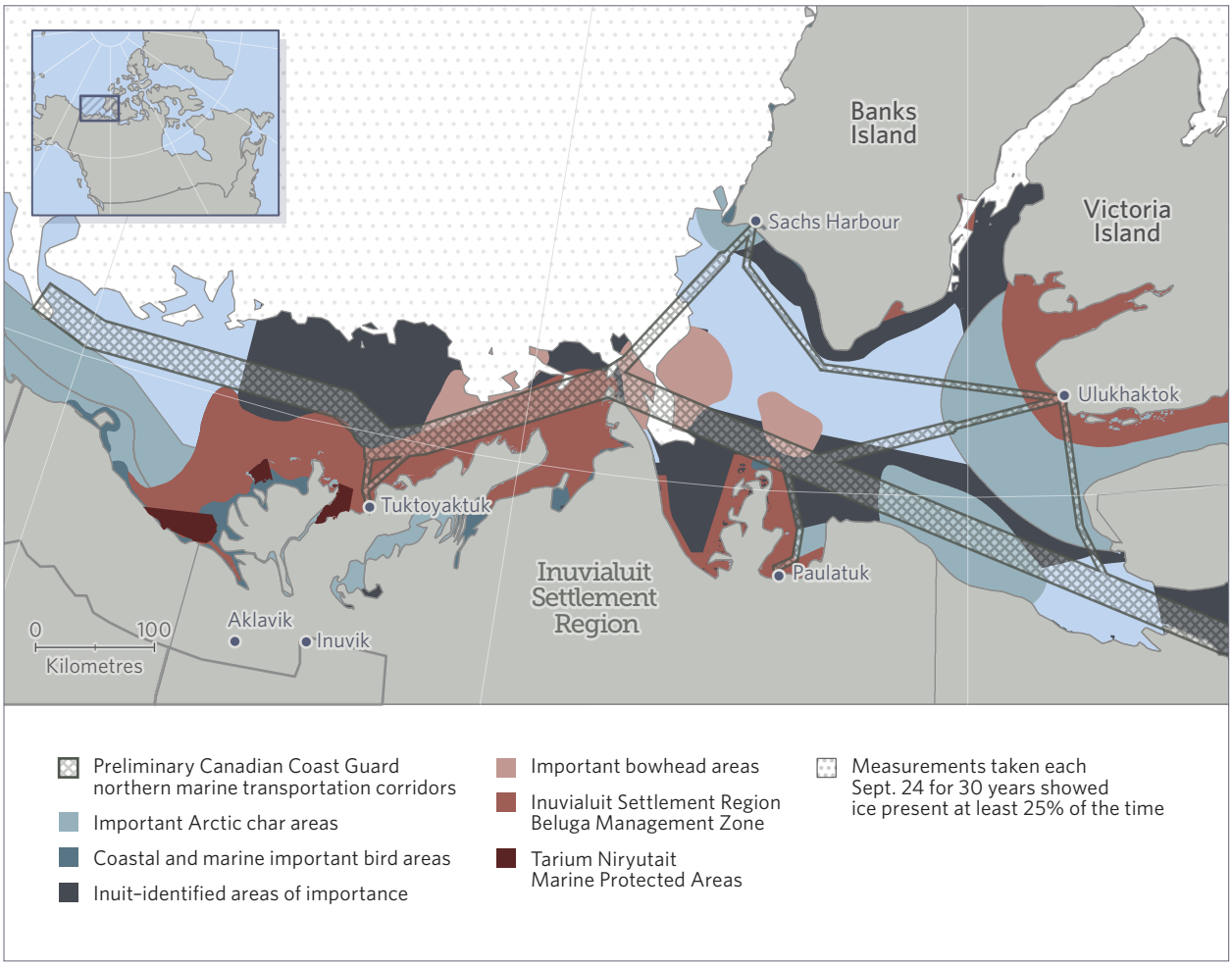


Sources: Canadian Coast Guard; Fisheries and Oceans Canada, 2010 Arctic Marine Workshop; Important Bird Areas Canada, http://www.ibacanada.ca/explore_how.jsp?lang=EN; Bureau of Ocean Energy Management, *Satellite Tracking of Bowhead Whales*, http://www.boem.gov/uploadedFiles/BOEM/BOEM_Newsroom/Library/Publications/BOEM_2013-01110_Satellite_Tracking.pdf; Nunavut Planning Commission, 2014 DNLUP Spatial Data, http://www.nunavut.ca/en/downloads; ISR Community Conservation Plan, http://jointsecretariat.ca/resources, and related spatial data; Beaufort Sea Partnership, "Tarium Niryutait Marine Protected Area," http://www.beaufortseapartnership.ca/tnmp_area.html; Canadian Ice Service, "30-Year Ice Atlas," http://iceweb1.cis.ec.gc.ca/30Atlas/page1.xhtml

Map 7

An Integrated Corridor System Would Create Cost-Effective, Safe, and Efficient Arctic Routing

Possible corridors through the Beaufort Sea and important areas, by type



Sources: Canadian Coast Guard; Fisheries and Oceans Canada, 2010 Arctic Marine Workshop; Important Bird Areas Canada, http://www.ibacanada.ca/explore_how.jsp?lang=EN; Bureau of Ocean Energy Management, *Satellite Tracking of Bowhead Whales*, http://www.boem.gov/uploadedFiles/BOEM/BOEM_Newsroom/Library/Publications/BOEM_2013-01110_Satellite_Tracking.pdf; Nunavut Planning Commission, 2014 DNLUP Spatial Data, http://www.nunavut.ca/en/downloads; ISR Community Conservation Plan, http://jointsecretariat.ca/resources; Beaufort Sea Partnership, "Tarium Niryutait Marine Protected Area," http://www.beaufortseapartnership.ca/initiatives/tarium-niryutait-marine-protected-area; Canadian Ice Service, "30-Year Ice Atlas," http://iceweb1.cis.ec.gc.ca/30Atlas/page1.xhtml

Table 2

Integrated Arctic Corridors Supplement the Benefits of the Coast Guard System

Comparison of shipping corridors in the Canadian Beaufort Sea, by type

Coast Guard Northern Marine Transportation Corridors Initiative	NMTCI With Integrated Arctic Corridors Framework
Corridor system covers 77,500 square kilometres (30,000 square miles) of the Canadian Beaufort Sea.	Corridors system covers 23,250 square kilometres—approximately 70% less area.
Between 2012-15, 60 % of commercial shipping traffic during the peak month of September occurred within the current corridors.	Between 2012-15, 68 % of commercial shipping traffic during the peak month of September occurred within the integrated corridors.
Corridor system affects 45% of regional ecological, biological, and Inuit areas of significance.	Corridors system affects 20% of regional ecological, biological, and Inuit areas of significance.
20% of designated corridors contain hazardous ice conditions.	Less than 5% of designated corridors contain hazardous ice conditions.
Not designed to include primary community resupply vessel patterns.	Designed to incorporate community resupply vessel patterns.
Corridors are voluntary.	Corridors are integrated into new and on-going regulatory reforms and initiatives.

Sources: Canadian Coast Guard; Fisheries and Oceans Canada, 2010 Arctic Marine Workshop; Important Bird Areas Canada, http://www.ibacanada.ca/explore_how.jsp?lang=EN; Bureau of Ocean Energy Management, *Satellite Tracking of Bowhead Whales*, http://www.boem.gov/uploadedFiles/BOEM/BOEM_Newsroom/Library/Publications/BOEM_2013-01110_Satellite_Tracking.pdf; Nunavut Planning Commission, 2014 DNLUP Spatial Data, http://www.nunavut.ca/en/downloads; ISR Community Conservation Plan, http://jointsecretariat.ca/resources, and related spatial data; Beaufort Sea Partnership, "Tarium Niryutait Marine Protected Area," http://www.beaufortseapartnership.ca/tnmp_area.html; Canadian Ice Service, "30-Year Ice Atlas," http://iceweb1.cis.ec.gc.ca/30Atlas/page1.xhtml

Step 5: Classify corridors

The hazardous and dynamic nature of the Canadian Arctic means that some shipping corridors will intersect with sensitive and high-risk areas. As proposed, 77 percent of the NMTCI corridors pass through areas that have been identified by government and Inuit as environmentally significant.[22] For important areas that cannot reasonably be excluded from the corridor system, establishing effective management interventions will be critical to the long-term viability of Arctic shipping and the sustainability of the ecosystem and Inuit subsistence practices.

To be effective, these management measures must correspond with the level of risk within each corridor. This tailored approach can be achieved by classifying the corridors according to three tiers of risk: low, medium, and high. (See Table 3.) Based on their tier, corridors would receive targeted investment and management, including environmental protected areas, enhanced services, site-specific contingency planning, improved charting, and enhanced regulation and oversight.

Table 3

Shipping Lanes Can Be Categorized by Risk to Ensure Proper Management

General characteristics of corridor tiers

Tier	Corridor characteristics
1—Low risk	Present limited risks to vessel and human safety, don't intersect with environmentally sensitive areas or marine mammal migration routes, and have no potential to significantly affect Inuit activities.
2—Medium risk	Pass through higher-risk marine areas, contain some environmentally sensitive areas, and/or potentially affect Inuit activities.
3—High risk	Contain areas that present great risks to vessel and human safety and/or major environmentally sensitive areas, affect at-risk species, and/or may significantly affect Inuit hunting areas, travel routes, or vital activities.

Source: Oceans North Canada

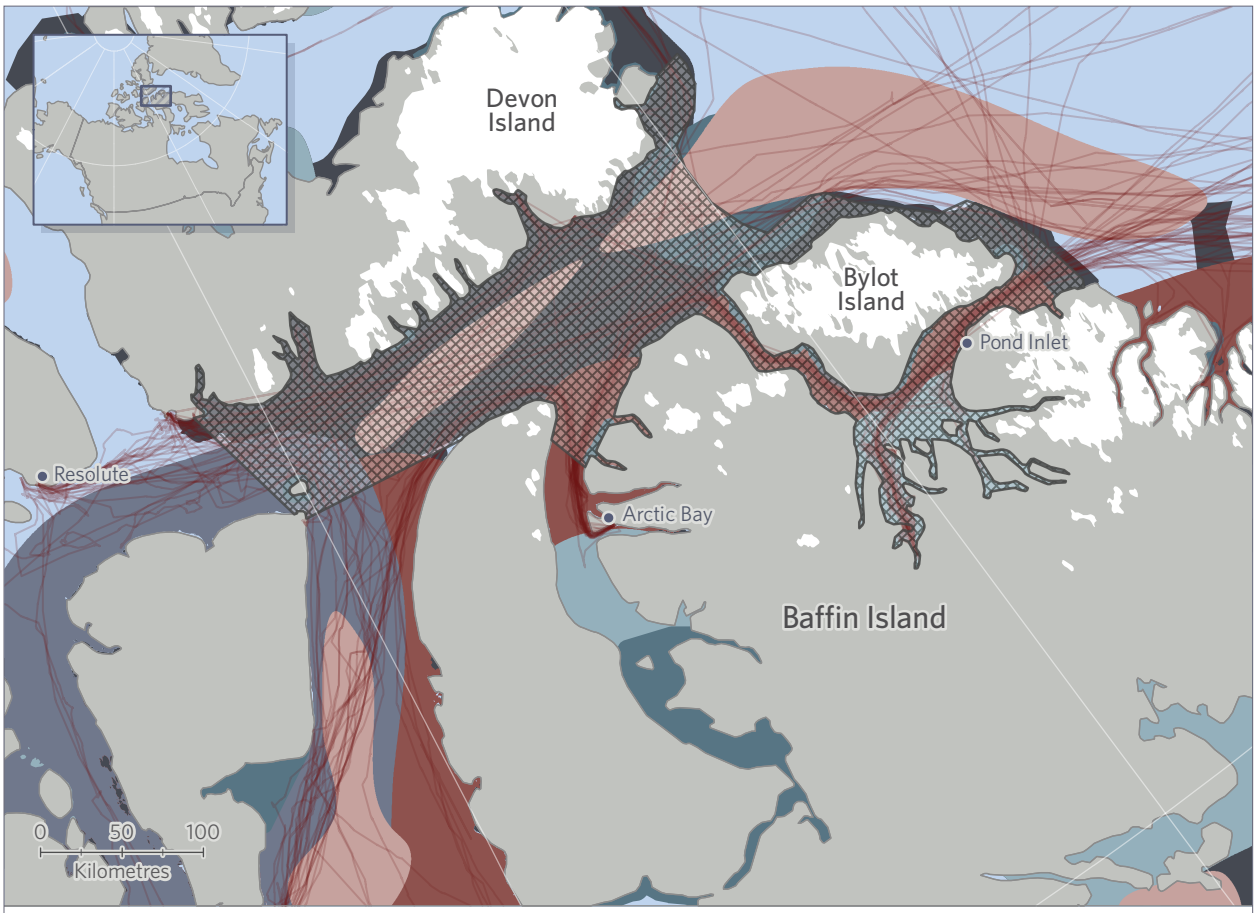
Corridors can be classified according to the level of risk to one or more of the following: passengers and crew, vessel safety, Inuit and northern communities, and the environment. Because the combination of risks will vary widely in the Arctic Ocean, classification will depend on the individual characteristics and circumstances of each corridor. The commission will be responsible for conducting assessments that weigh risks across all three principles.

A number of important shipping areas in the Canadian Arctic present high levels of risk across all three principles and are clear candidates for Tier 3 classification and corresponding levels of investment and management. One such area is Lancaster Sound, which is among the Canadian Arctic's most remote and biologically abundant environments. (See Map 8.) It is also the eastern entrance to the Northwest Passage, home to three Inuit communities, and the site of a future national marine conservation area. Lancaster Sound lies adjacent to one of Canada's most significant new mining developments, which will bring in some of the largest ships the region has ever hosted.

Map 8

Lancaster Sound Is a Complex Arctic Passage in Need of Tier 2 or Tier 3 Classification

Probable shipping routes and their overlap with various sensitive areas



Sources: exactAIS Archive, Satellite AIS Data—Arctic, http://www.exactearth.com; Important Bird Areas Canada, http://www.ibacanada.ca/explore_how.jsp?lang=EN; Charles G. Hannah, Frederic DuPont, and Michael Dunphy, "Polynyas and Tidal Currents in the Canadian Arctic Archipelago," *Arctic* 62, no. 1 (2009): 83–95, http://arctic.journalhosting.ucalgary.ca/arctic/index.php/arctic/article/view/115/149; Fisheries and Oceans Canada, 2010 Arctic Marine Workshop, http://www.dfo-mpo.gc.ca/Library/341178.pdf; Parks Canada, "Feasibility Assessment for the Proposed Lancaster Sound National Marine Conservation Area," http://www.pc.gc.ca/eng/progs/amnc-nmca/lancaster/carte-map.aspx

Benefits for Stakeholders

The Integrated Arctic Corridors Framework advances Arctic shipping in three ways: by providing a transparent and consistent framework upon which to base planning and decision-making, enabling collaboration and synergies through the Arctic Corridors Commission, and integrating the three key principles for Arctic shipping policy formation. In turn, these improvements will provide a set of benefits to Canada, the shipping industry, and the people of the North.

Canada

The framework will help Canada improve human and vessel safety in Arctic waters while providing the structure for robust environmental protection. The framework will strengthen human and vessel safety by prioritizing investments in infrastructure, services, and modern charting, facilitating logistics and decision-making within corridors, and discouraging shipping in hazardous areas outside the corridor system. In addition, effective management of integrated corridors should include common-sense incentives to encourage vessel modernization, infrastructural and communications improvements, and the development of regional human resource capacity. The framework will reduce risk to the environment by accounting for sensitive areas and by providing tools for more targeted management of marine species and habitat areas within designated corridors. Further, the process of developing integrated corridors brings attention to deficiencies in the current liability regime for Arctic shipping and enables Canada to address key liability concerns. Through iterative management, the integrated corridors system provides a flexible framework that can be adapted to changing circumstances in the highly dynamic Arctic environment.

Inuit

The framework will empower Inuit organizations by formally including them in corridor development and management, ensuring that Arctic shipping both benefits and does not threaten the long-term well-being of Canadian Inuit. The processes of corridor creation and management will give Inuit and the Canadian government a powerful tool for protecting important Inuit hunting areas and marine wildlife from the potential adverse effects of Arctic shipping. In addition, institutionalized coordination between federal departments and regional Inuit governments and organizations should result in enhanced oil spill response planning and other regional emergency response capacity. Investment in integrated Arctic corridors will improve infrastructure, lowering the cost of shipping to Inuit communities while promoting economic opportunity in the North.

Mariners and industry

The framework will benefit mariners and the shipping industry in a number of key ways. Most importantly, it will create a safer shipping environment for all vessels operating within the corridor system. Information gathering and investments in modern charting will help mariners identify the least risky areas for shipping and make more informed decisions. Designations of environmentally significant areas will allow ships to travel the safest possible route. Currently, limited emergency

Continued on the next page.

response capacity, infrastructure, incomplete charting, and unreliable communications systems present significant challenges to vessel operators seeking to obtain insurance.* Increased premiums for Arctic voyages may range from 25 percent to 100 percent higher than the non-Arctic alternative.† Investments in these areas will facilitate operators' access to maritime insurance.

* Kevin McGwin, "Lloyd's Guidelines to 'Complement' Polar Code," *The Arctic Journal*, March 18, 2014, http://arcticjournal.com/business/499/lloyds-guidelines-complement-polar-code.

† Charles Emmerson and Glada Lahn, *Arctic Opening: Opportunity and Risk in the High North,* Lloyd's (2012), https://www.chathamhouse.org/sites/files/chathamhouse/public/Research/Energy,%20Environment%20and%20Development/0412arctic.pdf.

Managing integrated Arctic corridors

The Integrated Arctic Corridors Framework, built on a system of tiered shipping corridors and governed by an Arctic Corridors Commission, would strengthen Canada's ability to manage shipping in the Arctic in three key ways:

1. Enabling the federal and territorial governments to create a mechanism for targeting and allocating resources toward priority Arctic marine infrastructure, information, and regional emergency response teams.
2. Supporting safe and responsible traffic by proposing vessel standards that correspond with the risk level of each corridor. Inuit participation in the commission would reduce the chance of vessels harming important Inuit areas.
3. Allowing Canada to more systematically monitor all variables, adapt to change in the dynamic Arctic environment, and promote regulatory and private-sector innovation.

Targeting resources

Canada's Arctic waters suffer from informational and infrastructural shortages, most notably in the areas of hydrographic data and modern charting; navigational aids; icebreaker capacity; on-shore infrastructure, such as ports, roads, and beacons; and oil spill response capacity, including equipment and trained personnel.[23] Only 1 percent of Canadian Arctic waters are adequately surveyed; 10 percent of nautical charts meet modern standards; 2 percent of Canada's navigational aids are deployed north of the Arctic Circle, and there are no deep-water ports. (See Map 9.)

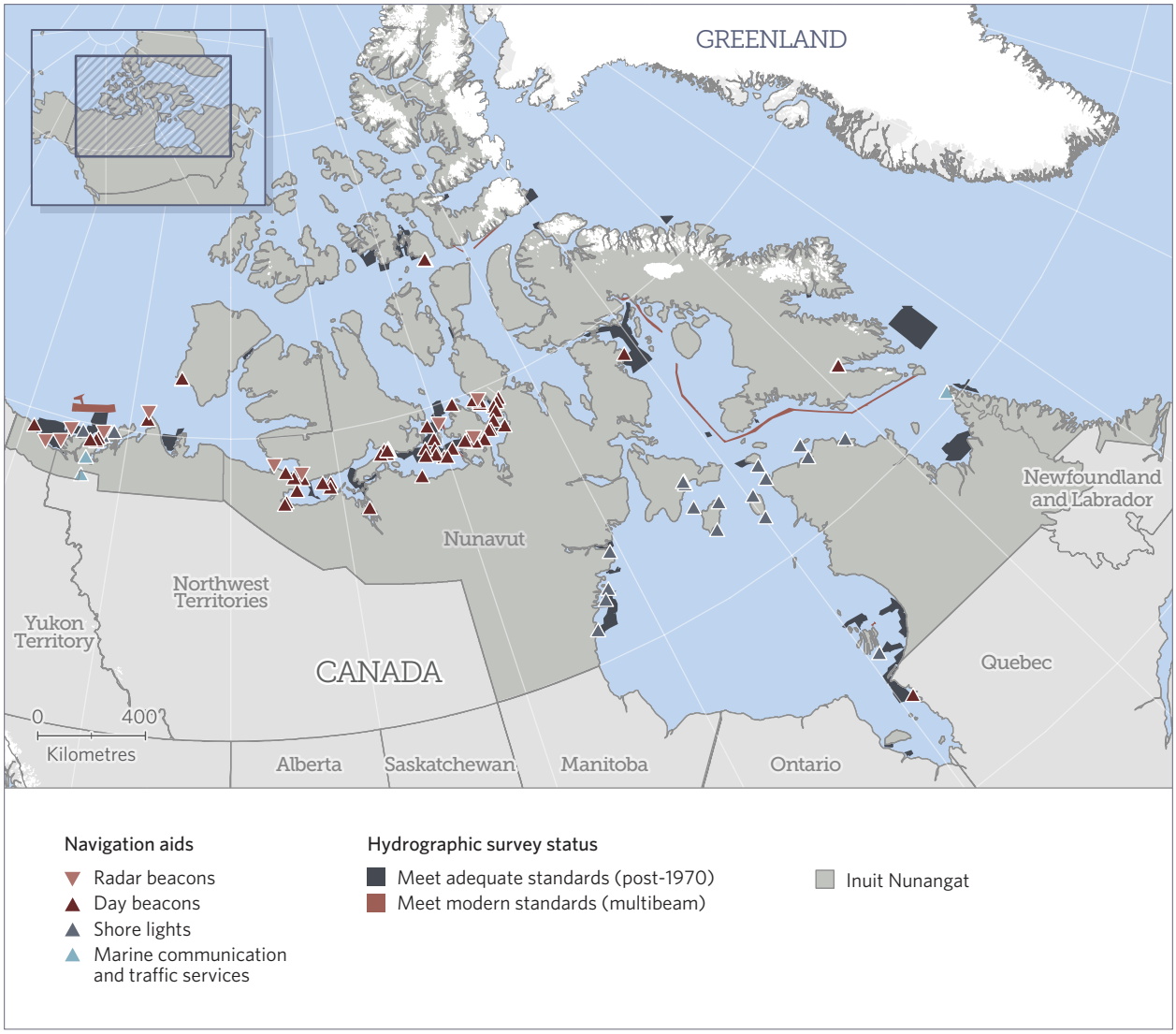
The process of developing modern nautical charting and building infrastructure to support Arctic shipping requires a comprehensive strategy for the allocation of government resources. The tiered corridor system would provide the foundation for strategic investment based on risk level, prioritizing investment for Tier 2 and 3 corridors. This approach would enable Canada to effectively support safe navigation for current levels and patterns of shipping and to plan for and build capacity in step with corridor-specific increases in vessel traffic over time.

Canada's current icebreaker capacity is a good indicator of its historic level of investment in Arctic shipping infrastructure. Of the five Arctic nations—Canada, Denmark (via Greenland), Norway, Russia, and the United States—Canada, which represents 41 percent of the world's Arctic coastline, has only six icebreakers, the least

Map 9

Hydrographic Data, Charting, and Other Facilities Are Inadequate to Support Shipping Growth

Navigational infrastructure in the Canadian Arctic, by type and level of modernization



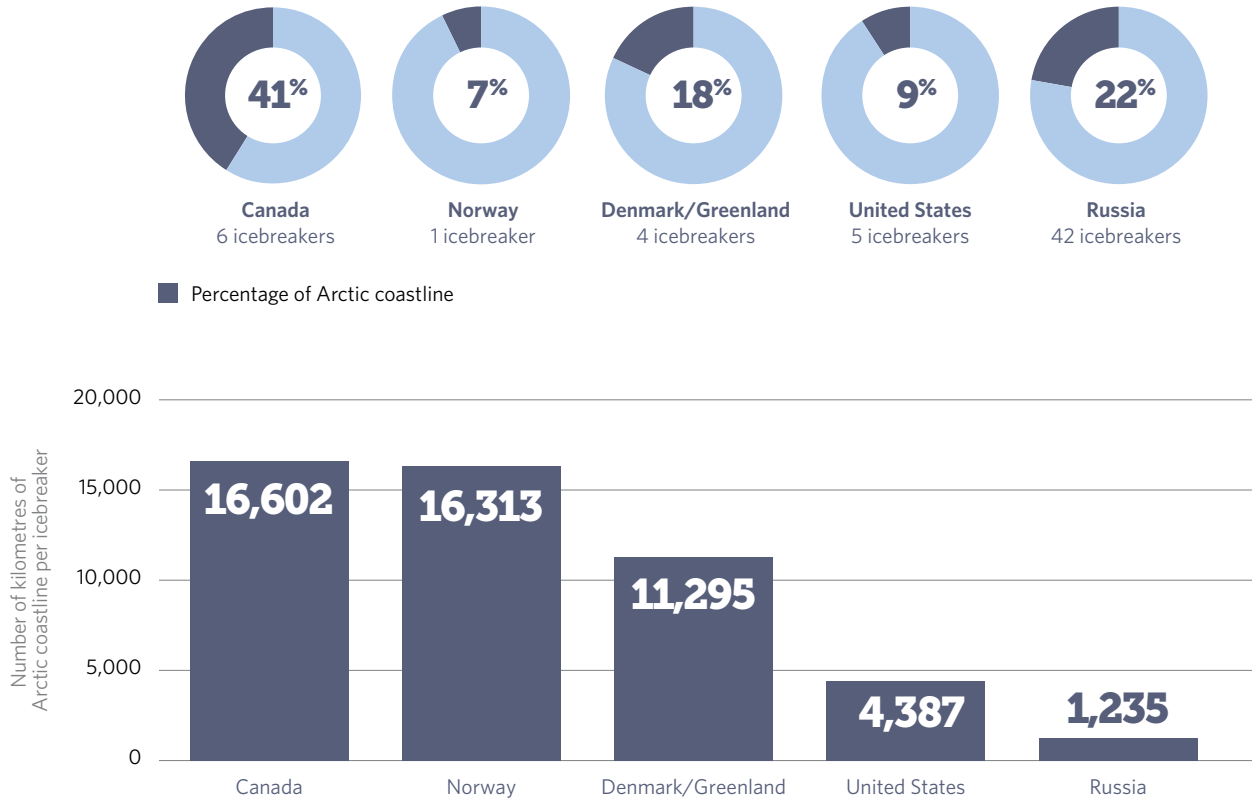
Sources: Fisheries and Oceans Canada, "Arctic Voyage Planning Guide," http://geoportal.gc.ca/eng/Maps/Viewer/5#fc; Office of the Auditor General of Canada, "Marine Navigation in the Canadian Arctic," 2014 Fall Report of the Commissioner of the Environment and Sustainable Development, http://www.oag-bvg.gc.ca/internet/English/parl_cesd_201410_03_e_39850.html#ex1

amount of coverage per kilometre of Arctic coastline. (See Figure 3.) By comparison, Russia has about 13.5 times the icebreaker capacity of Canada, and the U.S., with 9 percent of the Arctic coastline, has five icebreakers. Further, the auditor general found that although shipping activity in the Arctic was increasing, the Coast Guard's icebreaking presence was decreasing.[24]

Figure 3

Canada Has the Lowest Icebreaking Capacity as a Percentage of Arctic Coastline Among Arctic Nations

Number of icebreakers per country, by percentage and kilometres of coastline



Source: GRID-Arendal, "Boundaries of the Arctic Council Working Groups," http://www.grida.no/graphicslib/detail/boundaries-of-the-arctic-council-working-groups_8385

Supporting safe and responsible vessel traffic

As previously noted, the framework would advance the NMTCI's goal of supporting safe and responsible vessel activity in five key ways:

- First, the corridor system would build on the protections achieved through Canada's existing regulatory mechanisms. In particular, it would extend the reach of Canada's Ship Safety Control Zones, an established risk-based management regime for Arctic shipping that regulates standards and access according to historical levels of seasonal sea ice.[25] In addition, by utilizing the Arctic Pollution Prevention Regulations in corridor designation and classification, the framework could establish vessel standards and navigational rules that reflect the level of risk in each corridor, taking into account seasonal variations.

- Second, the framework would provide a structure through which Canada could revisit its rules related to liability limits for ship-based pollution events. Current limits underestimate the costs of response, remediation, and victim compensation compared with past efforts around the world. Because of the challenges inherent in responding to spills in Arctic waters, the cost will be magnified.
- Third, the identification of special areas for enhanced environmental management, including designations such as marine protected areas, would protect ecologically sensitive places within the corridor system.
- Fourth, the framework calls for site-specific contingency planning (including for worst-case scenarios) in designated areas in order to reduce the risks to the environment and Inuit communities. This is common practice for ship-source contingency planning in other countries, such as the United States and Australia.
- Finally, permanent mechanisms for ongoing engagement and consultation with Inuit groups would be developed to ensure that Inuit rights are being protected and that opportunities for Inuit involvement in the management and monitoring regime are identified and pursued.

Oil spills from near-shore vessels represent the greatest shipping-related threat to the people and environment of the Arctic. As noted earlier, seven studies have made 57 distinct recommendations for addressing Canada's lack of preparedness for an Arctic oil spill. Map 10 illustrates the need for planning and investment in oil spill response capacity. Had the Nanny spilled its cargo of 9.5 million litres of diesel fuel in the passage south of King William Island, a responding agency would have needed a minimum of 4½ to 6½ days to mount a medium to major response operation. This is significant because the first 24 hours are the most critical period for containing an oil spill and preventing environmental damage, and mechanical removal of spilled oil is most effective when the oil is at its densest, before it has been mixed by wave action. The importance of deploying sufficient equipment within the first day after an oil spill is internationally recognized and is often built into law. California, for example, mandates that significant response capacity be deployed within six hours of a spill.

Monitoring and adapting to change

The Arctic environment is changing at an unprecedented rate, which is affecting ecosystems, Inuit practices, and shipping interests. And shipping traffic will not increase uniformly over time. It will intensify over short periods in specific corridors associated with resource extraction and destination shipping. Further, variability in annual sea ice,[26] species-specific habitat use, and long-term environmental changes are difficult to predict. One of the greatest strengths of the tiered corridors approach is that it creates a flexible, risk-based system that can accommodate environmental changes and traffic increases.

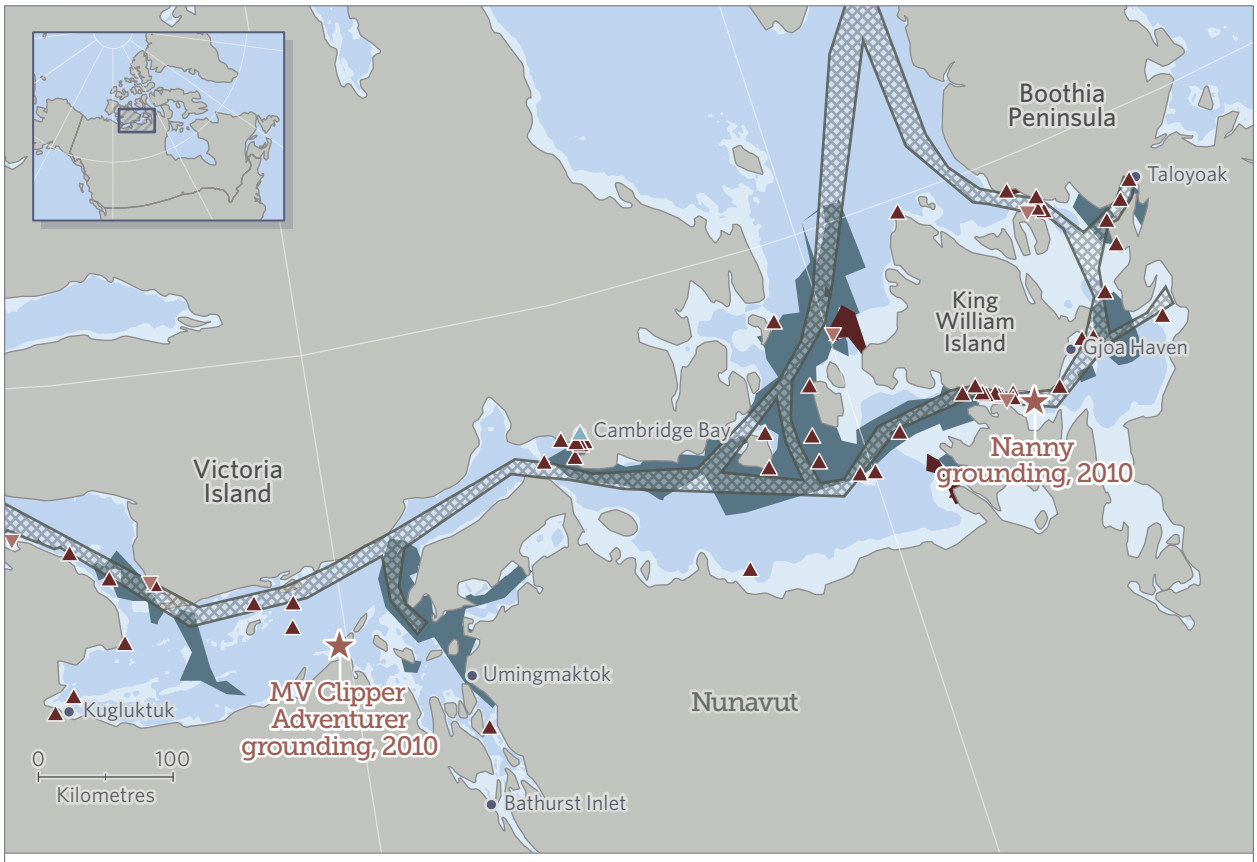
The key to creating a nimble and adaptable system is to establish a monitoring program that focuses on changes to corridor use and environmental impacts, enabling the commission to review corridor designations and classifications and to develop new management strategies. This iterative and adaptive approach ensures that as shipping patterns and environmental conditions change, corridors continue to be managed in the most effective way possible and that human and vessel safety, environmental protection, and Inuit rights are balanced and optimized.

As part of its management strategy, the framework should encourage and incentivize innovation in the areas of communications, infrastructure, ships and equipment, and the training of personnel, including community first responders. Canada has a record of successful public-private and federal-territorial partnerships to support similar advances in other areas such as the development of the Canadian High Arctic Research Station.[27] Of singular importance is the modernization of the shipping fleet used to resupply Arctic communities.

Map 10

The Arctic Presents a Host of Unique Challenges to Marine Shipping Emergency Prevention and Response

Hazardous conditions in the Kitikmeot region of Canada's Northwest Passage



Sources: Transportation Safety Board of Canada, "Marine Investigation Report—Grounding: Tanker Nanny" (2012), http://www.tsb.gc.ca/eng/rapports-reports/marine/2012/m12h0012/m12h0012.asp, and "Marine Investigation Report—Grounding: Passenger Vessel Clipper Adventurer" (2010), http://www.bst-tsb.gc.ca/eng/rapports-reports/marine/2010/m10h0006/m10h0006.asp; Canadian Coast Guard; Fisheries and Oceans Canada, "Arctic Voyage Planning Guide," http://geoportal.gc.ca/eng/Maps/Viewer/5#fc; National Oceanic and Atmospheric Administration, "International Bathymetric Chart of the Arctic Ocean," http://www.ngdc.noaa.gov/mgg/bathymetry/arctic; Office of the Auditor General of Canada, "Marine Navigation in the Canadian Arctic," *2014 Fall Report of the Commissioner of the Environment and Sustainable Development*, http://www.oag-bvg.gc.ca/internet/English/parl_cesd_201410_03_e_39850.html#ex1; Natural Resources Canada, "Atlas of Northern Canada" (2012), http://geogratis.gc.ca/api/en/nrcan-rncan/ess-sst/702ebdea-39ff-50e4-ab5f-de1150d16b7a

Recommendations

Over the past two decades, government agencies, academics, and civil society groups have made recommendations to improve Canadian Arctic shipping policy in order to minimize marine casualties and environmental emergencies. The recommendations in this section build on their work and connect it to the Integrated Arctic Corridors Framework outlined above.

Create a forum and governance structure for Arctic shipping corridor development and management

Building and managing integrated corridors requires the collaboration of a number of government bodies and Inuit groups. To effectively facilitate this coordination and cooperation, the Coast Guard should create and lead a Canadian Arctic Corridors Commission. The commission should be co-chaired by the Coast Guard and Inuit and charged with leading the process that culminates with the design and adoption of the framework.

1. Include representatives from Transport Canada, Environment Canada, and Fisheries and Oceans Canada, all three territorial governments, and appropriate Inuit land claims organizations.
2. Serve as the permanent management body with a mandate to administer the system of integrated Arctic corridors.

Consult and meaningfully engage Inuit

Canada has a constitutional obligation to consult and meaningfully engage Inuit on matters that have the potential to affect economic, social, and environmental dimensions of life in the Arctic. The Arctic Corridors Commission must:

1. Enter into formal consultations with all settled Inuit land claims regions to ensure appropriate participation in domestic and international shipping policy creation and negotiation. Formal consultations must provide the opportunity for Inuit traditional knowledge about sensitive marine and coastal areas to shape corridor designation, classification, and management.
2. Create a national process to gather Inuit views on shipping in the Arctic.
3. Develop effective communication channels between government agencies and Inuit organizations.
4. Establish official linkages with local, regional, national, and international Inuit governance bodies responsible for managing the Arctic marine environment.

Integrate information

The process of information gathering will prepare the way for the creation of an interactive online Canadian Arctic marine atlas, which will synthesize all available data related to Inuit use and occupancy as well as Arctic fish, marine mammal, and bird populations, to ultimately inform creation of the corridors. The atlas will be an essential tool to define important hunting areas, community-identified conservation planning zones, wildlife migration routes, species-specific management plans, important cultural sites, and marine protected areas. To gather and collate the information necessary to build integrated Arctic shipping corridors, the Canadian government must:

1. Allocate adequate funding to fill existing critical information gaps.
2. Provide the Canadian Hydrographic Service and the Coast Guard with additional resources to carry out hydrographic surveys of all potential shipping corridors, prioritizing the most potentially hazardous areas.

3. Collect, synthesize, and incorporate existing hydrographic and other related shipping data (such as analysis of vessel traffic, ice, and relevant environmental information) from government agencies and partners.
4. Conduct regional risk assessments of shipping in the Canadian Arctic, focusing on high-risk areas and those that are important to communities as well as key Arctic passages. This activity would include gathering the necessary data for risk assessments, including ecosystem data.
5. Conduct ecosystem-based scientific studies on marine mammals and habitat that require special protection.
6. Design and implement an Arctic monitoring system to ensure the long-term health of important ecological and biological areas.

Designate corridors

Shipping in certain areas of the Canadian Arctic should be discouraged. Once an integrated mapping and assessment process has identified the optimal shipping routes, the Arctic Corridors Commission should formally establish a system of corridors that excludes sensitive areas. To achieve this, the commission must:

1. Aggregate all sensitive marine areas identified through Inuit local and traditional knowledge and create and determine areas that should be excluded from shipping corridors.
2. Identify environmentally significant areas that have no or very low levels of vessel traffic and exclude them from designated corridors.
3. Analyze potential shipping routes and determine the lowest-risk corridors as they relate to human and vessel safety, environmental protection, and Inuit rights.
4. Scrutinize corridor width and placement to minimize overlap with sensitive areas and those important to Inuit and wildlife migratory routes.

Classify corridors

The level of risk to ships and from ships to wildlife, the environment, and indigenous communities varies greatly throughout the Canadian Arctic. To manage corridors efficiently, the commission must classify them into three tiers according to assessed risk (low, medium, and high), and to do so, the commission must:

1. Create local and regional maps of high-risk areas.
2. Use the risk assessments conducted during the information-integration stages to identify where shipping corridors pass through high-, medium-, and low-risk areas.

Target resources

In the face of increasing vessel traffic, deficiencies in maritime infrastructure and services must be addressed through targeted investment in corridors. To this end, the Canadian Arctic Corridors Commission must:

1. Request an infrastructure needs assessment that includes port and harbour infrastructure, on-shore facilities (e.g., waste reception, oil transfer, refuelling stations), communications (including automatic identification system receivers and Internet connectivity), icebreaker capacity, aids to navigation, search and rescue, and spill response equipment.
2. Develop short-, medium-, and long-term infrastructure strategies that include investigation of potential funding mechanisms, such as public-private partnerships and fees for service.
3. Build capacity to respond to a worst-case scenario ship-source oil spill in remote Canadian Arctic waters.

Support safe and responsible vessel traffic

Innovative and collaborative management is necessary to effectively mitigate the risks presented by increased shipping. To effectively manage vessel activities over time, the Arctic Corridors Commission must:

1. Develop a management plan that includes environmental protections, safety standards for vessels and crew, and protection for Inuit practices.
2. Pursue regulatory controls for corridors based on changes to ship construction, equipment, voyage planning, and crew requirements for access to Ship Safety Control Zones under the Arctic Shipping Pollution Prevention Regulations.
3. Establish protections for environmentally sensitive areas within and adjacent to corridors including those with International Maritime Organization designations, such as Special Areas, Emission Control Areas, and Particularly Sensitive Sea Areas.

Monitor and adapt to change

The Canadian Arctic is experiencing an unprecedented rate of change in both environmental conditions and shipping traffic. Corridors can be adapted to new circumstances by reviewing designations, classifications, investments, and management approaches. To optimize safety and environmental protection over time, the Arctic Corridors Commission must:

1. Support and integrate baseline environmental assessment and monitoring in vulnerable areas along designated corridors.
2. Establish a vessel monitoring program that includes regular monitoring, ship inspections, corridor surveillance, and incident review.
3. Periodically review and reassess designations, classifications, investments, and management approaches based on information from monitoring or on significant changes to shipping activities and patterns.

Conclusion

Climate change is warming the Arctic Ocean. The permanent Arctic polar ice pack continues to recede. In coming years, the Arctic will host important shipping routes for minerals, oil and gas, and other commercial goods. In Canada, vessel traffic through the Northwest Passage already has increased by 166 percent over the past decade. Government, industry, and Inuit organizations agree that Canada's Arctic shipping policy needs to advance to meet these challenges.

The Integrated Arctic Corridors Framework offers an innovative blueprint for bringing all stakeholders together around an achievable national policy for Arctic shipping. Through the creation, development, and management of integrated corridors, the framework would make shipping in the Canadian Arctic safer and more affordable while strengthening environmental protections and protecting Inuit rights. Importantly, the framework would be built to adapt as conditions change in this dynamic and complex area.

Implementation of the framework would solidify Canada's position as a global leader in Arctic policy and diplomacy and could help to spark a new era of cooperation with Canada's international Arctic partners. Although much of the present international policy discussion presupposes rivalry and conflict among the Arctic nations, responsible economic development, human and vessel safety, environmental protection, and Inuit rights are priorities all Arctic nations and their peoples share, and the framework presents a holistic plan that could serve as a road map for pan-Arctic solutions to the next generation of shipping challenges.

Endnotes

1 Larissa Pizzolato et al., "Changing Sea Ice Conditions and Marine Transportation Activity in Canadian Arctic Waters Between 1990 and 2012," *Climatic Change* 123, no. 2 (2014): 161–173, http://dx.doi.org/10.1007/s10584-013-1038-3.

2 Office of the Auditor General of Canada, "Chapter 3: Marine Navigation in the Canadian Arctic," *2014 Fall Report of the Commissioner of the Environment and Sustainable Development*, http://www.oag-bvg.gc.ca/internet/English/parl_cesd_201410_03_e_39850.html. Canadian government agencies are tasked with managing the world's largest national coastline and must therefore allocate resources carefully. A 2014 audit of marine navigation in the Canadian Arctic found that existing resource allocation is insufficient to meet current and future needs of vessels, in particular with respect to hydrographic surveying, aids to navigation, and icebreaker deployment.

3 Fisheries and Oceans Canada, *Report on Plans and Priorities 2013-14: Organizational Priorities*, http://www.dfo-mpo.gc.ca/rpp/2013-14/rpp-eng.html.

4 Office of the Auditor General of Canada, "Chapter 3: Marine Navigation in the Canadian Arctic."

5 To date, the CCG corridors initiative has been based on ensuring that the appropriate maritime services and systems are in place to support safe navigation in the Arctic.

6 Ship routing measures that discourage access or prescribe operational conduct can be used to encourage safe routing choices and protect sensitive marine habitat or important cultural areas. IMO regulations and the Canada Shipping Act of 2001 allow for the designation of specific shipping routes and vessel traffic control systems, including mandatory routing and speed restrictions that are important regulatory tools with the potential to greatly reduce the risk of marine mammal strikes at key times.

7 Intergovernmental Panel on Climate Change, *Climate Change 2014: Synthesis Report* (Rajendra K. Pachauri, Leo Meyer, and The Core Writing Team, eds.) http://www.ipcc.ch/pdf/assessment-report/ar5/syr/SYR_AR5_FINAL_full.pdf.

8 Office of the Auditor General of Canada, "Chapter 3: Marine Navigation in the Canadian Arctic."

9 Canada's Arctic coastline and waterways are contained within the boundaries of five settlement Inuit land claims: James Bay and Northern Quebec Agreement (1977), Inuvialuit Final Agreement (1984), Nunavut Land Claims Agreement (1995), Labrador Inuit Land Claims Agreement (2005), and Nunavik Inuit Land Claims Agreement (2008). The provisions of these agreements are protected by Canada's Constitution Act.

10 Transportation Safety Board of Canada, *Marine Investigation Report M10H0006* (2010), http://www.bst-tsb.gc.ca/eng/rapports-reports/marine/2010/m10h0006/m10h0006.asp.

11 Canada has worked with international organizations to assess and regulate Arctic shipping, notably through the Arctic Marine Shipping Assessment and the Polar Code. Domestically, the Office of the Auditor General, the Standing Senate Committee on Fisheries and Oceans, Transport Canada, and the Tanker Safety Panel have each assessed and reported on various aspects of Arctic shipping over the past six years. These domestic and international initiatives have sparked calls for wide-ranging policy and legislative reform.

12 Canadian Coast Guard, "Northern Marine Transportation Corridors Initiative," Company of Master Mariners of Canada, April 29, 2014, http://www.mastermariners.ca/maritimes/uploads/05marinecorridors.pdf.

13 Fisheries and Oceans Canada, "Identification of Ecologically and Biologically Significant Areas in the Canadian Arctic," *Canadian Science Advisory Secretariat Science Advisory Report 2011/055*, http://www.dfo-mpo.gc.ca/csas-sccs/Publications/SAR-AS/2011/2011_055-eng.pdf.

14 Senate of Canada Standing Committee on Fisheries and Oceans, *Rising to the Arctic Challenge: Report on the Canadian Coast Guard* (2009), http://www.parl.gc.ca/Content/SEN/Committee/402/fish/rep/rep02may09-e.pdf.

15 Inuit Tapiriit Kanatami, "Inuit See Value in New Federal Arctic Shipping Regulations—Insist on Greater Inuit Involvement," July 10, 2010, https://www.itk.ca/media/media-release/inuit-see-value-new-federal-arctic-shipping-regulations-insist-greater-inuit.

16 Haida Nation v. British Columbia (Minister of Forests), 2004 SCC 73, and Beckman v. Little Salmon/Carmacks First Nation, 2010 SCC 53. The concept of the "honour of the Crown" is part of Canada's constitution, and the duty to consult and accommodate is part of the supporting doctrine of that underlying principle. The content of the duty to consult and accommodate varies with circumstances. The scope is proportionate to a preliminary assessment of the strength of the case supporting the existence of the right or title and to the seriousness of the potentially adverse effect upon the right or title claimed.

17 The leading case on the trigger to the duty is the Supreme Court of Canada's decision in Haida Nation v. British Columbia. In that case, the Court concluded that Canada must engage in meaningful consultation and accommodation when "the Crown has knowledge, real or constructive, of the potential existence of the Aboriginal right or title and contemplates conduct that might adversely affect it."

18 Corinne Pomerleau et al., *Canadian Arctic Marine Biodiversity Plan 2014–2017. Canadian Component of the Conservation of Arctic Flora and Fauna's Circumpolar Biodiversity Monitoring Program Arctic Marine Biodiversity Monitoring Plan* (Akureyri, Iceland: Conservation of Arctic Flora and Fauna International Secretariat, 2014), http://www.caff.is/monitoring-series/23-all-monitoring-documents/278-canadian-arctic-marine-biodiversity-plan-2014-2017.

19 Tanker Safety Panel Secretariat, *A Review of Canada's Ship-Source Spill Preparedness and Response: Setting the Course for the Future, Phase II—Requirements for the Arctic and for Hazardous and Noxious Substances Nationally*, Transport Canada (2014), https://www.tc.gc.ca/media/documents/mosprr/TC-Tanker-E-P2.pdf.

20 S.L. Ross Environmental Research Ltd., *Spill Response Gap Study for the Canadian Beaufort Sea and the Canadian Davis Strait*, National Energy Board (2011), https://docs.neb-one.gc.ca/ll-eng/llisapi.dll/fetch/2000/90463/621169/700096/702787/A2A6V0_-_SL_Ross_Environmetal_Research_Limited_-_Spill_Response_Gap_Study_for_the_Canadian_Beaufort_Sea_and_the_Canadian_Davis_Strait.pdf?nodeid=702903&vernum=-2. In the near offshore environment of the Beaufort Sea, spill response is not possible at any time between mid-October and June. During open water periods, feasibility of spill response ranges from 80 percent (June) to 35 percent (early October). In west-central Davis Strait, spill response is not possible at any time between December and July. During open water periods, feasibility of spill response ranges from 65 percent (July) to 16 percent (November).

21 Initiatives such as the Beaufort Sea Regional Environmental Assessment began mapping environmental sensitivities to oil and gas developments; other government initiatives such as Aboriginal Affairs and Northern Development Canada's Northern Oil and Gas Petroleum and Environmental Management Tool have also recorded areas sensitive to development and disturbance, enabling potential oil and gas lessees to view possible interactions of their developments with the environment.

22 Preliminary northern marine transportation corridors were digitized from a map used in a presentation given by the Canadian Coast Guard for the Company of Master Mariners of Canada, http://www.mastermariners.ca/maritimes/uploads/05marinecorridors.pdf.

23 Arctic Council, *Arctic Marine Shipping Assessment 2009 Report*, http://pame.is/images/03_Projects/AMSA/AMSA_2009_report/AMSA_2009_Report_2nd_print.pdf; Office of the Auditor General of Canada, "Chapter 3: Marine Navigation in the Canadian Arctic"; Tanker Safety Panel Secretariat, *A Review of Canada's Ship-Source Spill Preparedness and Response: Setting the Course for the Future, Phase II.*

24 Office of the Auditor General of Canada, "Chapter 3: Marine Navigation in the Canadian Arctic."

25 Ship Safety Control Zones have been established under the Arctic Shipping Pollution Prevention Regulations of the Arctic Waters Pollution Prevention Act. The Canadian Arctic is divided into 16 zones that are used to restrict ship access based on the ice regime in the zone and the construction standards of the ship and that enable the government of Canada to control ship access to certain maritime areas based on risk. This regime provides an important foundation from which to develop regulatory tools to support safety and environmental protection within medium- and high-risk corridors (Tiers 2 and 3).

26 Stephen E.L. Howell et al., "Multiyear Ice Replenishment in the Canadian Arctic Archipelago: 1997–2013," *Journal of Geophysical Research: Oceans* 120, no. 3 (2015): 1623–1637, http://onlinelibrary.wiley.com/doi/10.1002/2015JC010696/full. While declining sea ice is improving ship access, it will also result in increasingly hazardous multiyear ice floes, more unpredictable weather, and more severe sea states.

27 This new federal organization was established through the Canadian High Arctic Research Act, which came into force by Order in Council on June 1, 2015. It combines the resources and knowledge of the former Canadian Polar Commission and Science and Technology program at Aboriginal Affairs and Northern Development Canada into one organization and will anchor a strong research presence in Canada's Arctic to serve Canada and the world.

> Pew is not opposed to offshore drilling, but believes a balanced and careful approach to development must account for environmental protection, as well as the social, cultural, and subsistence needs of Inuit communities.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