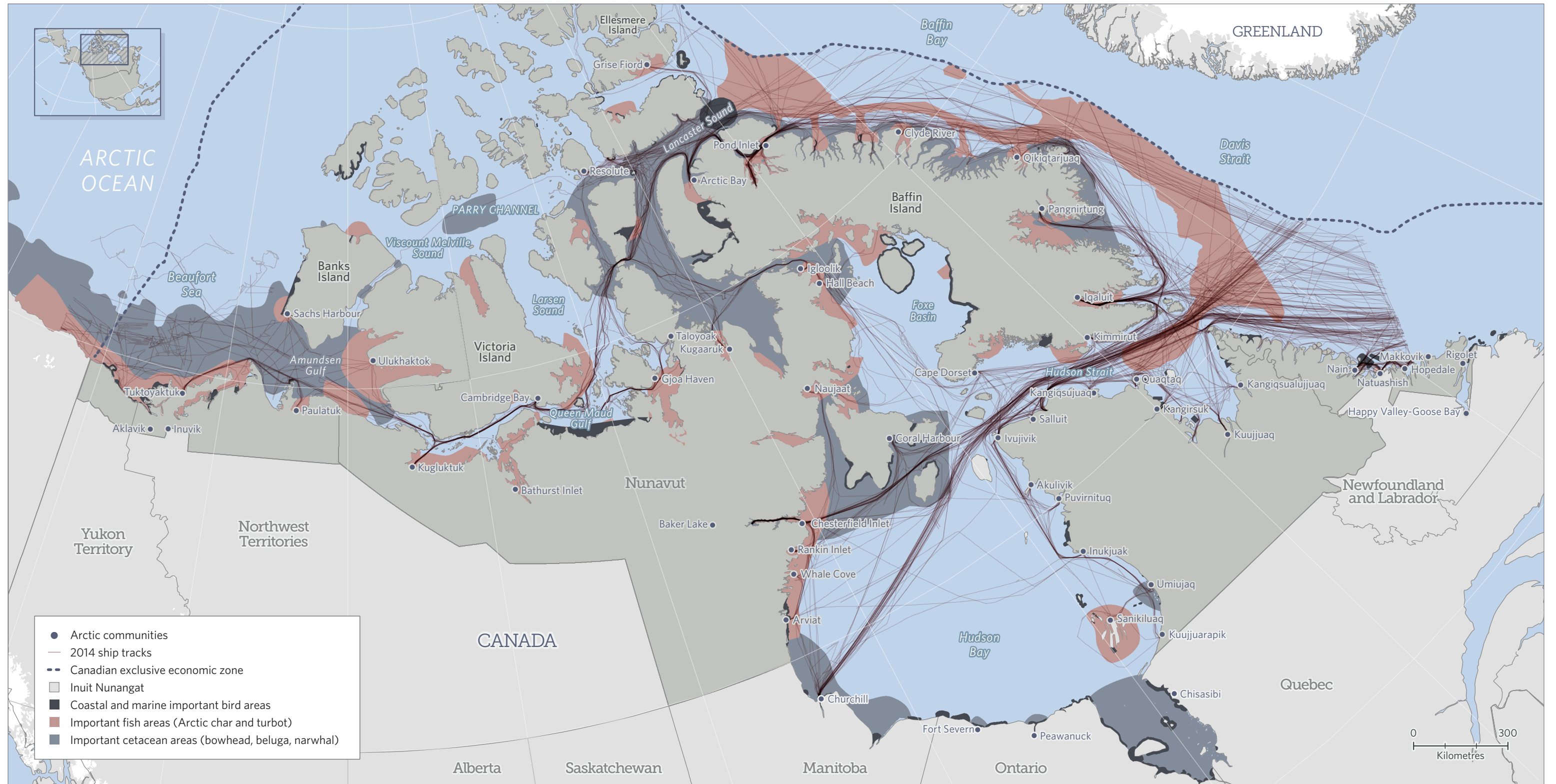


Canada's Arctic Passageways Are Shared by Ships and Wildlife

Vessel, whale, fish, and bird movements

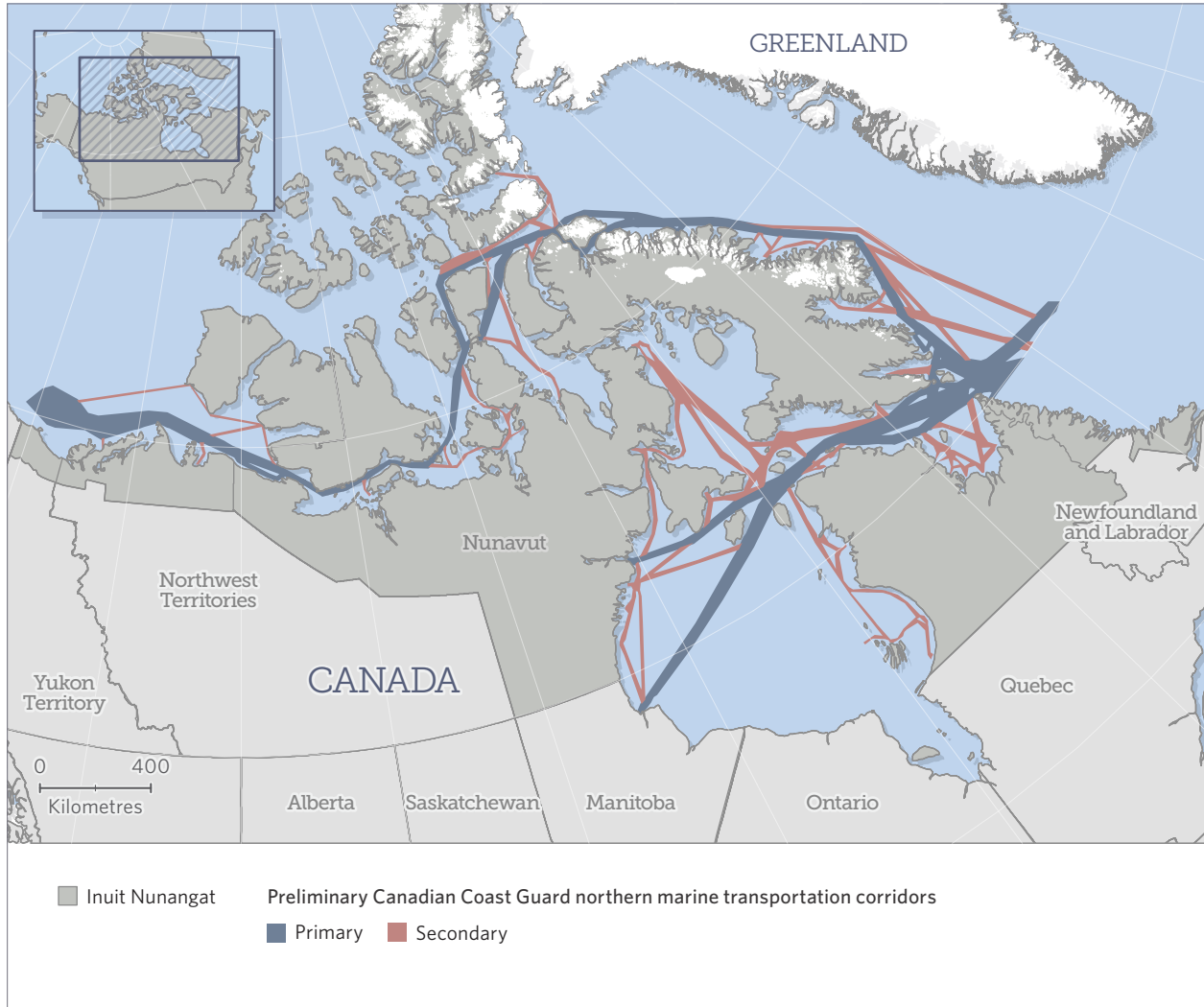


Sources: Important Bird Areas Canada, http://www.ibacanada.ca/explore_how.jsp?lang=EN; Fisheries and Oceans Canada, 2010 Arctic Marine Workshop, <http://www.dfo-mpo.gc.ca/Library/341178.pdf>; Bureau of Ocean Energy Management, *Satellite Tracking of Bowhead Whales* (2013), <http://www.data.boem.gov/PI/PDFImages/ESPIS/5/5343.pdf>; 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>

Map 2

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

Primary and secondary northern marine transportation corridors



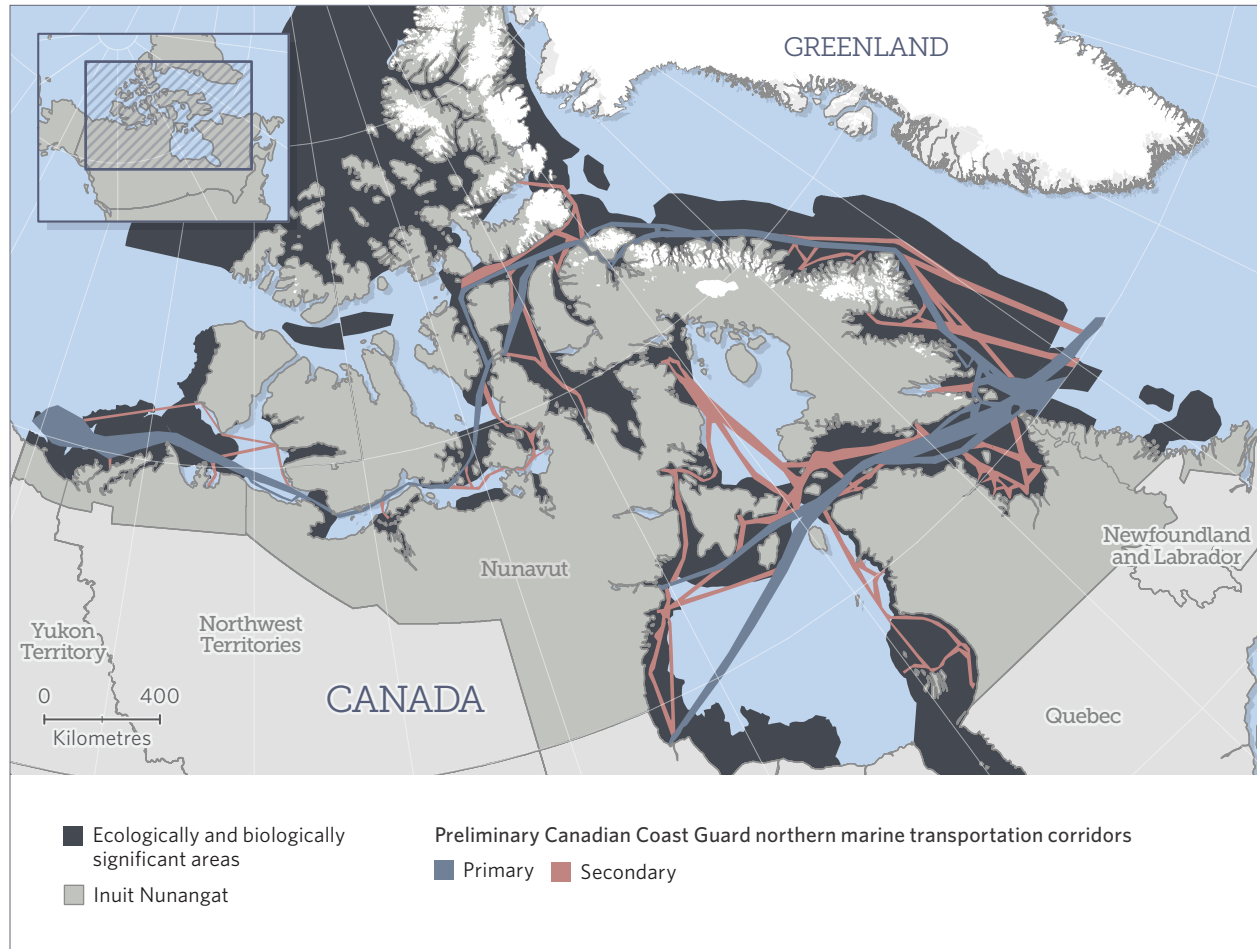
Source: Canadian Coast Guard, "Northern Marine Transportation Corridors Initiative," Company of Master Mariners of Canada, April 29, 2014, <http://www.mastermariners.ca/maritimes/uploads/05marinecorridors.pdf>

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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



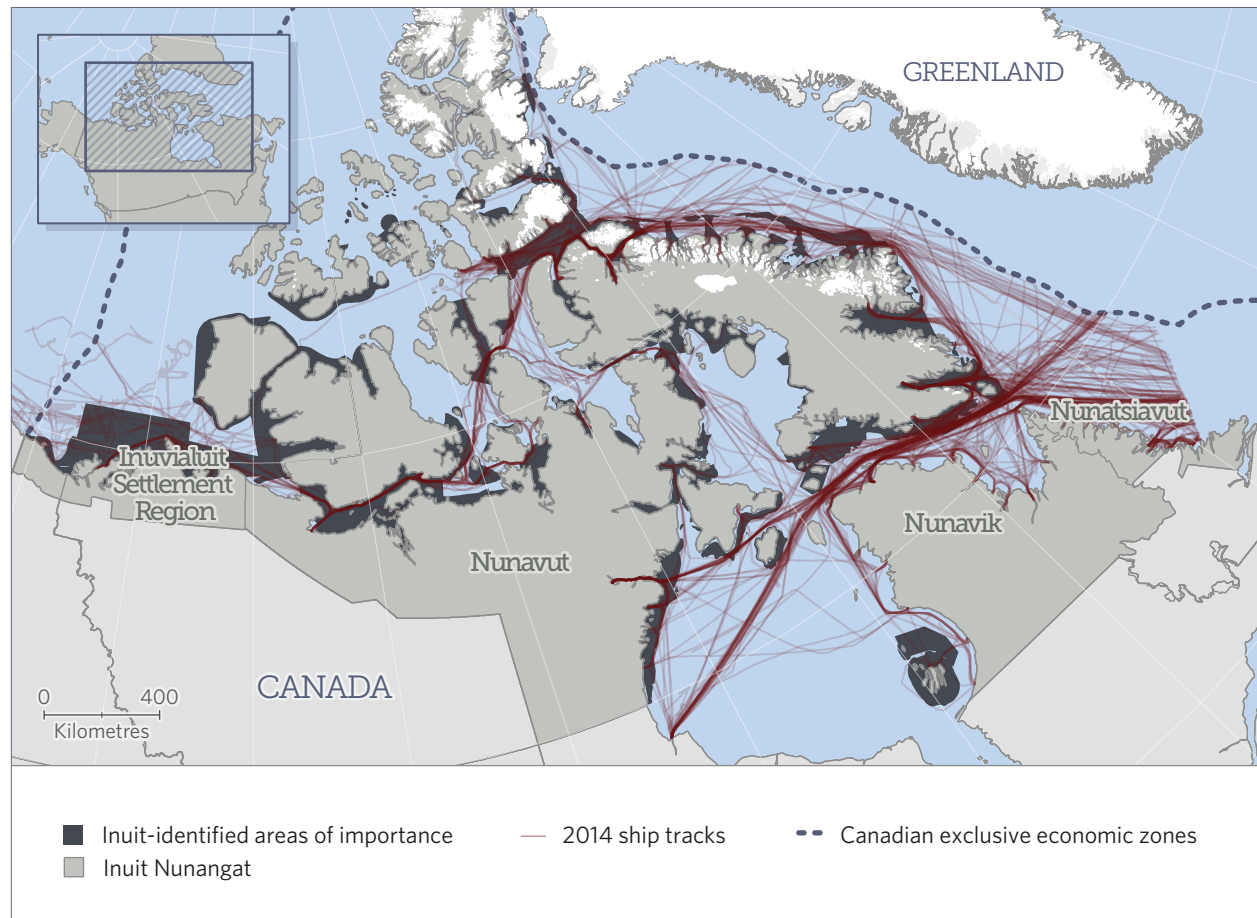
Sources: Canadian Coast Guard, "Northern Marine Transportation Corridors Initiative," Company of Master Mariners of Canada, April 29, 2014, <http://www.mastermariners.ca/maritimes/uploads/05marinecorridors.pdf>; Fisheries and Oceans Canada, "Identification of Ecologically and Biologically Significant 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

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Map 4

Canadian Arctic Shipping Traffic Intersects Many Inuit-Use Areas

Shipping patterns and identified Inuit areas of importance, 2014



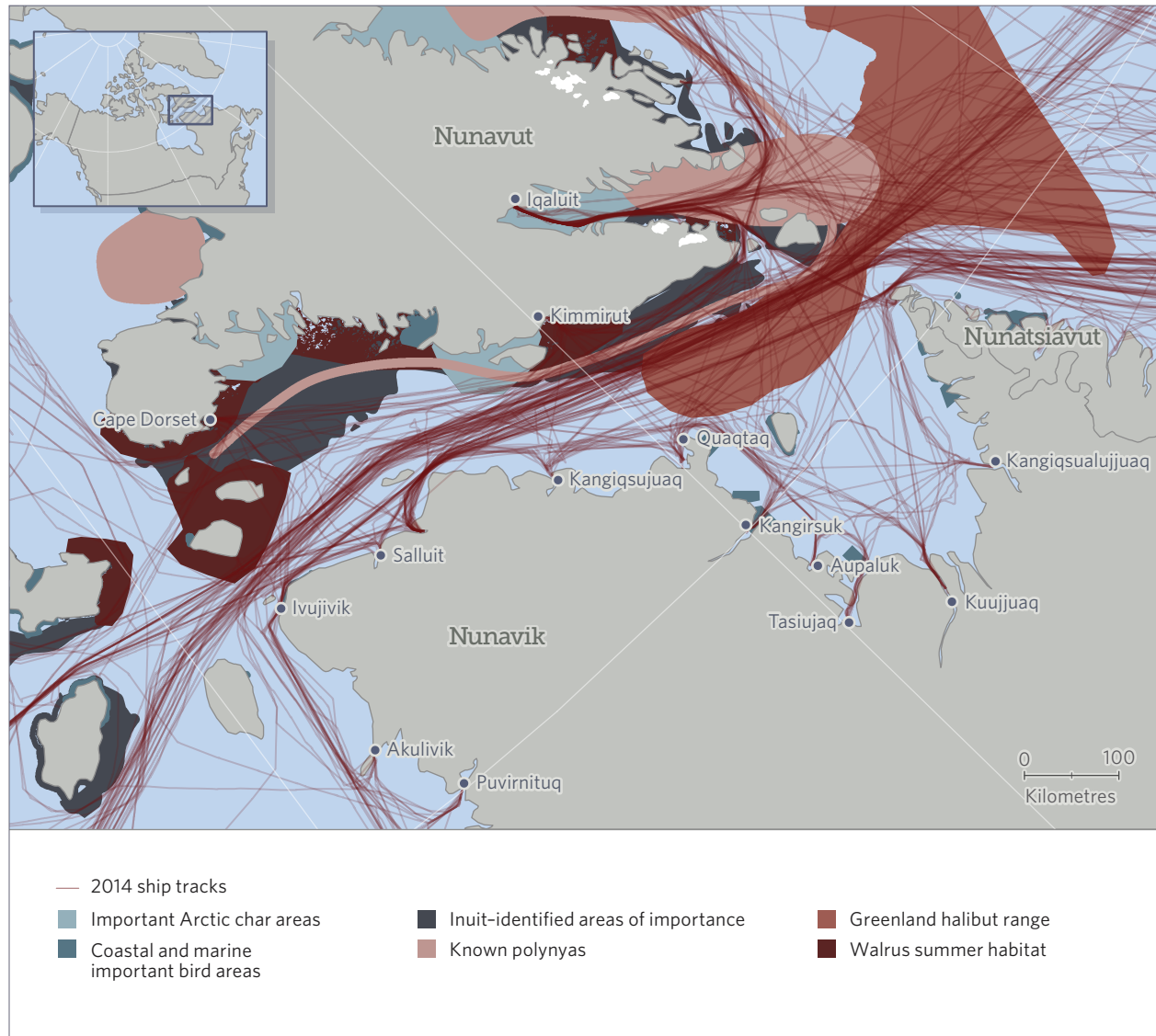
Sources: exactAIS Archive, Satellite AIS Data—Arctic, <http://www.exactearth.com>; Nunavut Planning Commission, 2014 Draft Nunavut Land Use Plan (DNLUP) Spatial Data, <http://www.nunavut.ca/en/downloads>; Inuvialuit Settlement Region (ISR) Community Conservation Plan, <http://jointsecretariat.ca/resources>;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

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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

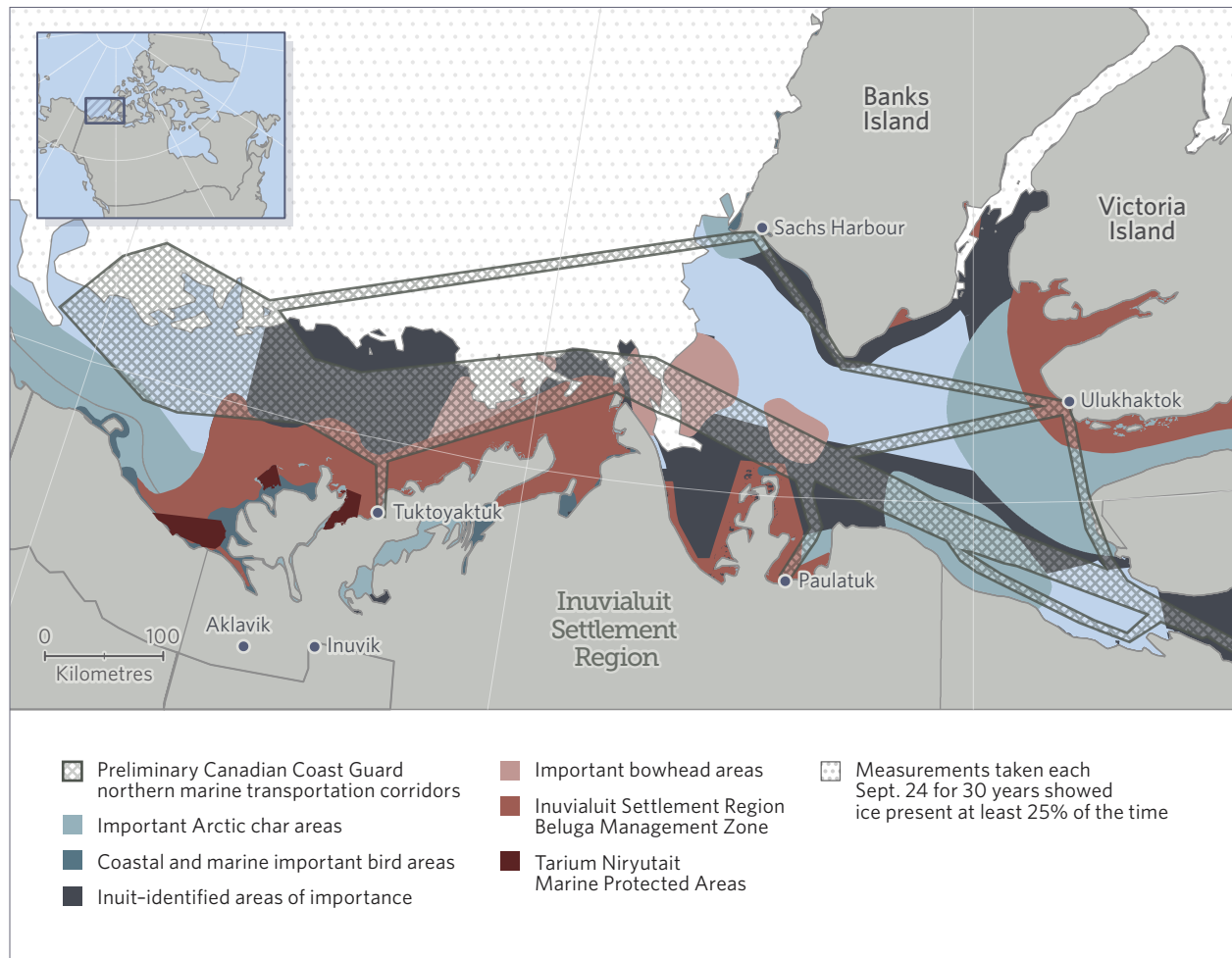


Sources: exactAIS Archive, Satellite AIS Data—Arctic, <http://www.exactearth.com>; Fisheries and Oceans Canada, 2010 Arctic Marine Workshop; Important Bird Areas Canada, http://www.ibacanada.ca/explore_how.jsp?lang=EN; Nunavut Planning Commission, 2014 DNLUP Spatial Data, <http://www.nunavut.ca/en/downloads>; 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>

Map 6

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

Current Coast Guard routes and important areas, by type

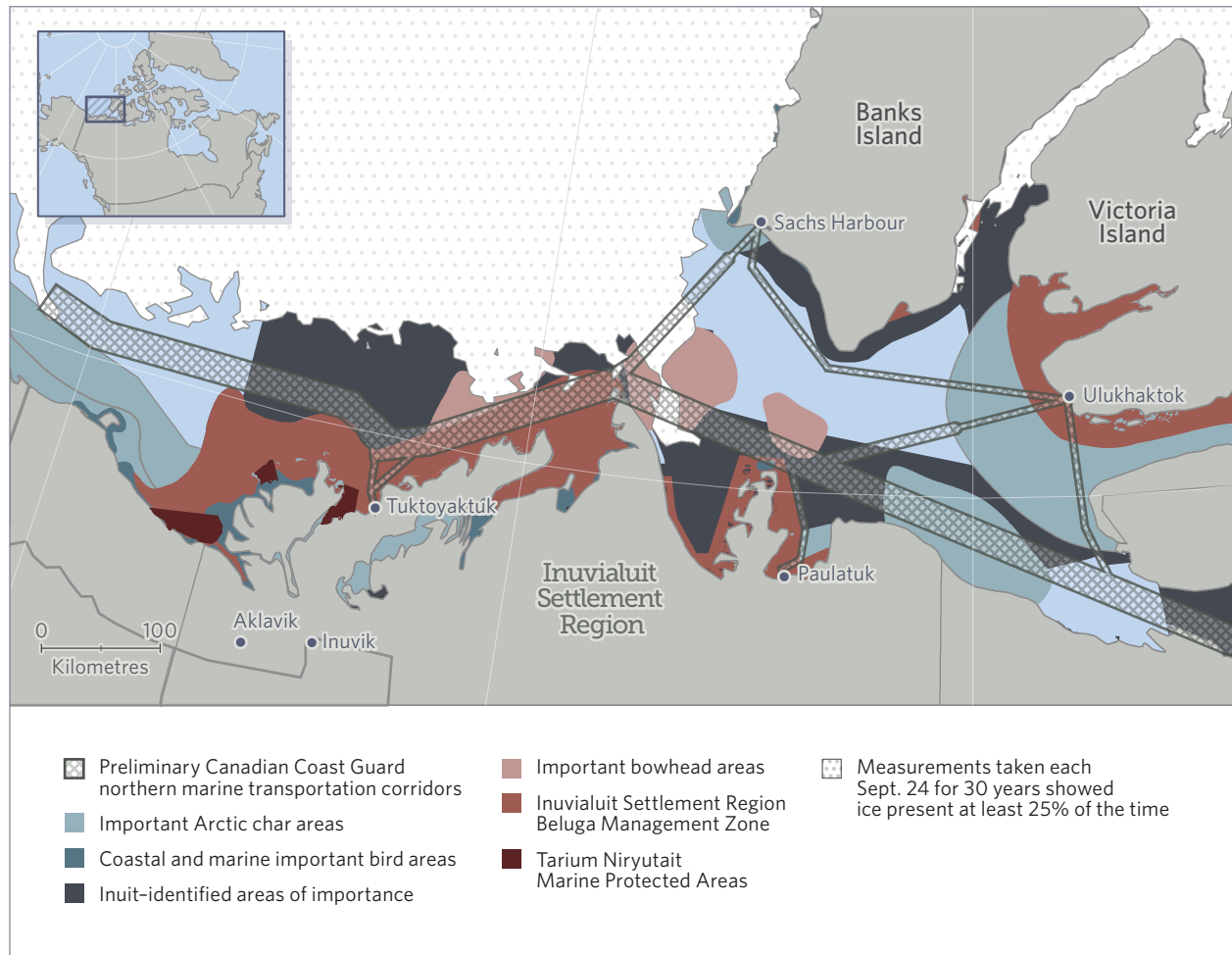


Sources: Canadian Coast Guard; Fisheries and Oceans Canada, 2010 Arctic Marine Workshop; Important Bird Areas Canada, http://www.ibacanada.ca/explore_how.jsp?lang=EN; Bureau of Ocean Energy Management, *Satellite Tracking of Bowhead Whales*, http://www.boem.gov/uploadedFiles/BOEM/BOEM_Newsroom/Library/Publications/BOEM_2013-01110_Satellite_Tracking.pdf; 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

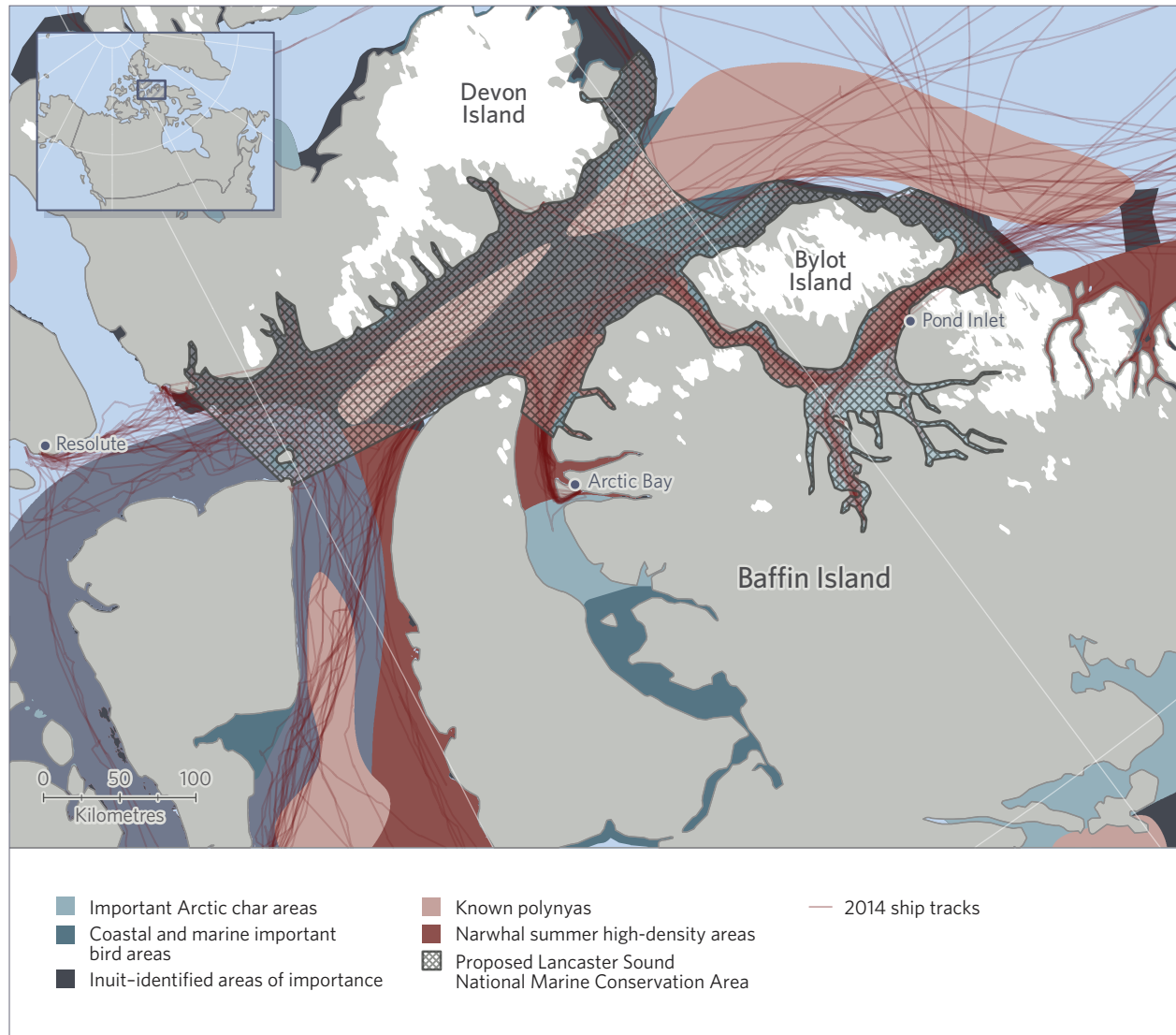


Sources: Canadian Coast Guard; Fisheries and Oceans Canada, 2010 Arctic Marine Workshop; Important Bird Areas Canada, http://www.ibacanada.ca/explore_how.jsp?lang=EN; Bureau of Ocean Energy Management, *Satellite Tracking of Bowhead Whales*, http://www.boem.gov/uploadedFiles/BOEM/BOEM_Newsroom/Library/Publications/BOEM_2013-01110_Satellite_Tracking.pdf; 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>

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

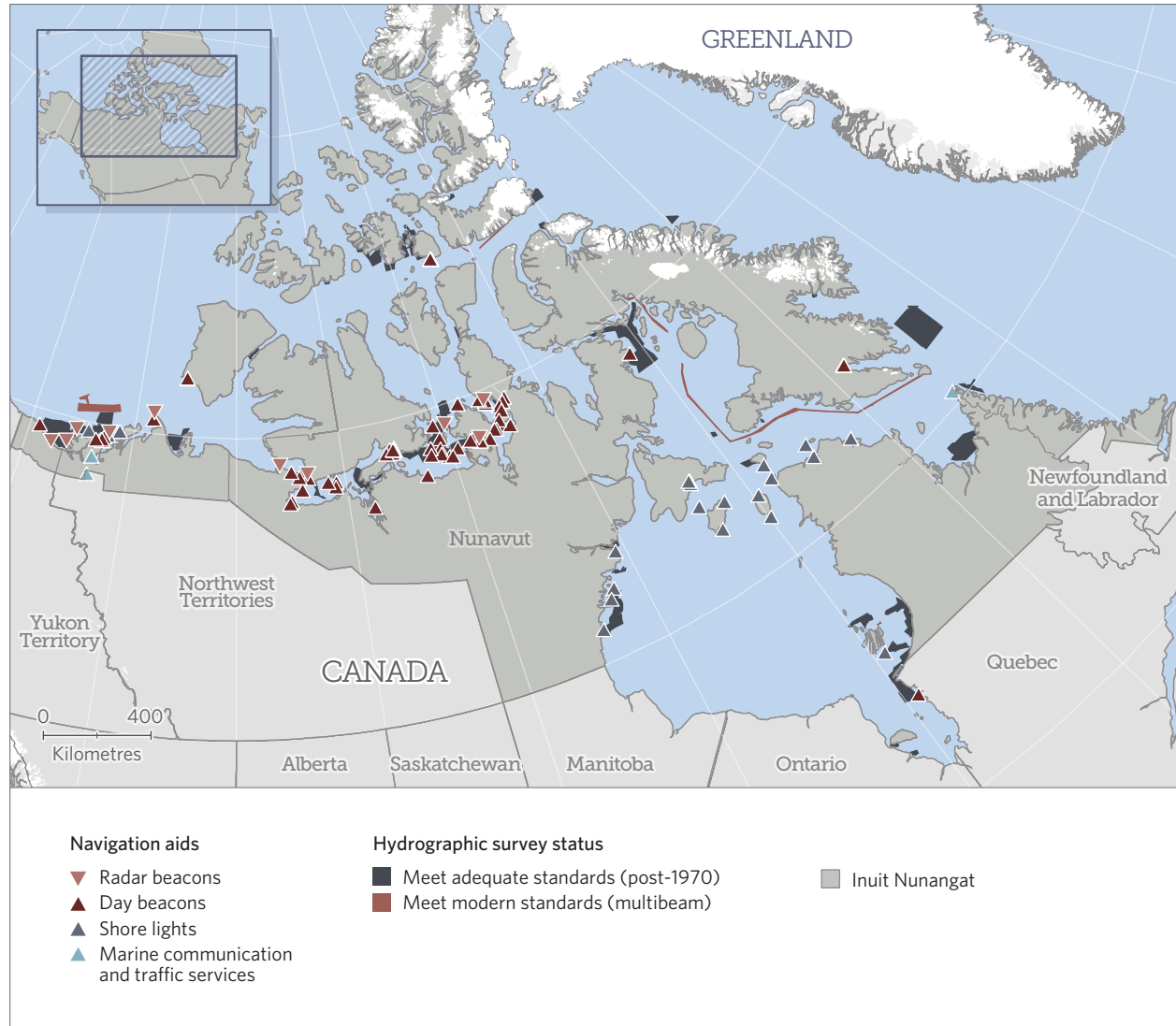


Sources: exactAIS Archive, Satellite AIS Data—Arctic, <http://www.exactearth.com>; Important Bird Areas Canada, http://www.ibacanada.ca/explore_how.jsp?lang=EN; Charles G. Hannah, Frederic DuPont, and Michael Dunphy, "Polynyas and Tidal Currents in the Canadian Arctic Archipelago," *Arctic* 62, no. 1 (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>

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



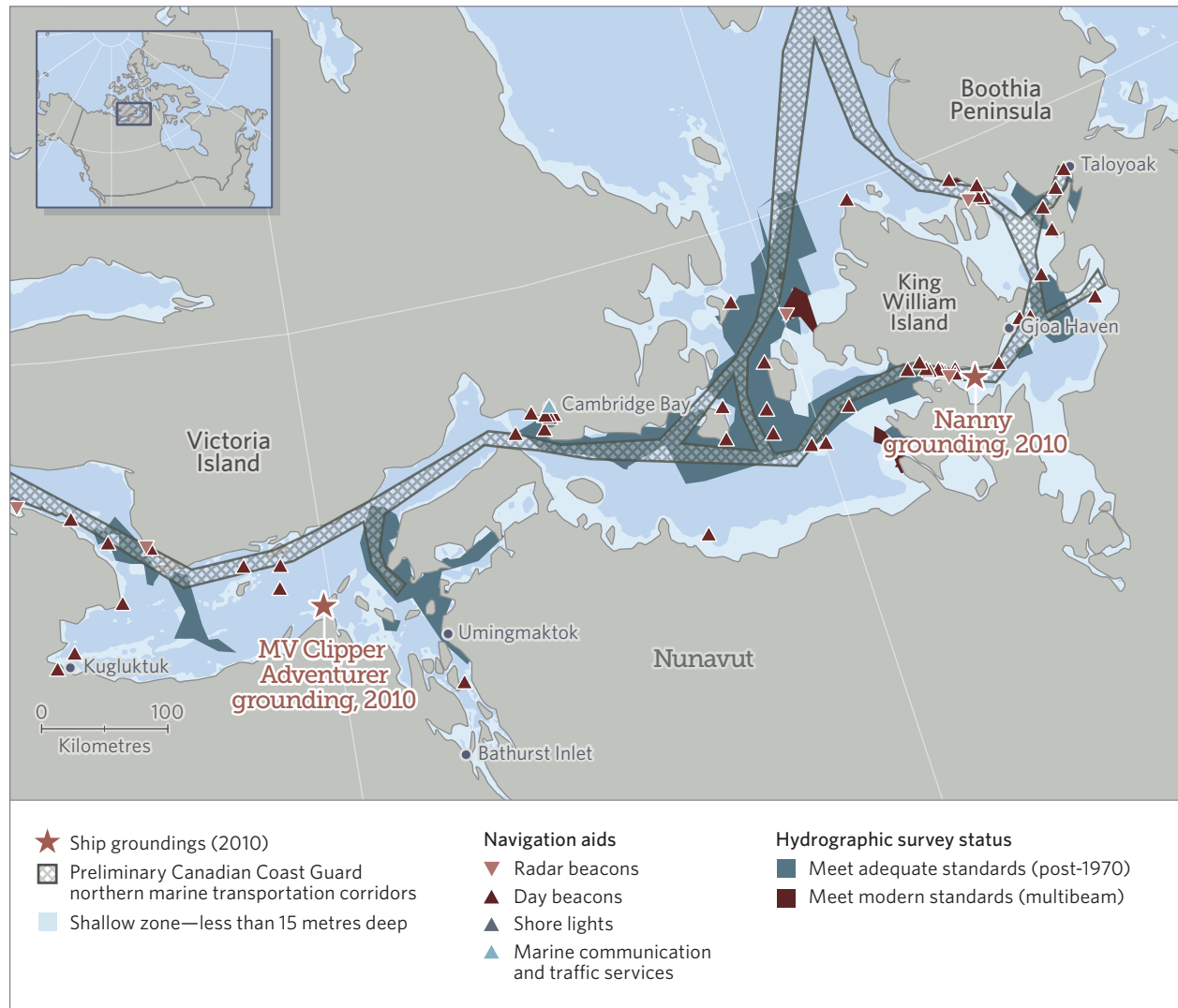
Sources: Fisheries and Oceans Canada, "Arctic Voyage Planning Guide," <http://geoportal.gc.ca/eng/Maps/Viewer/5#fc>; Office of the Auditor General of Canada, "Marine Navigation in the Canadian Arctic," 2014 Fall Report of the Commissioner of the Environment and Sustainable Development, http://www.oag-bvg.gc.ca/internet/English/parl_cesd_201410_03_e_39850.html#ex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

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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

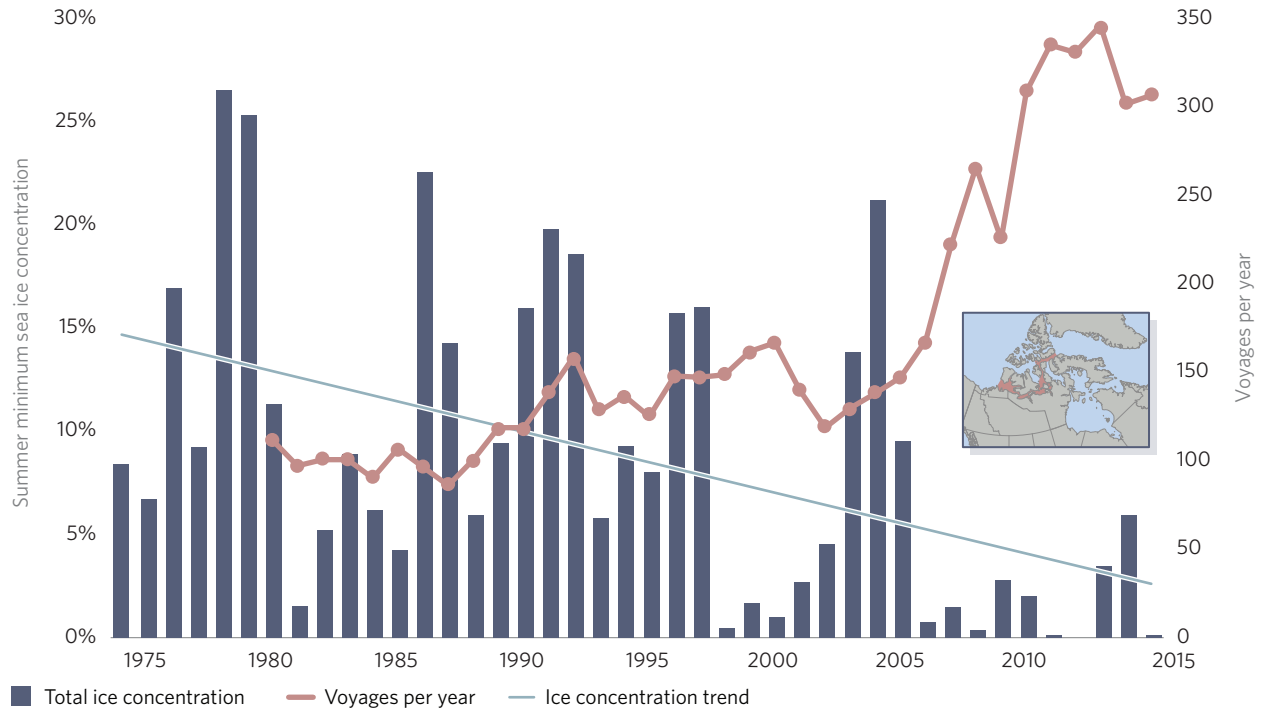


Sources: Transportation Safety Board of Canada, "Marine Investigation Report—Grounding: Tanker Nanny" (2012), <http://www.tsb.gc.ca/eng/rappports-reports/marine/2012/m12h0012/m12h0012.asp>, and "Marine Investigation Report—Grounding: Passenger Vessel Clipper Adventurer" (2010), <http://www.bst-tsb.gc.ca/eng/rappports-reports/marine/2010/m10h0006/m10h0006.asp>; Canadian Coast Guard; Fisheries and Oceans Canada, "Arctic Voyage Planning Guide," <http://geoportal.gc.ca/eng/Maps/Viewer/5#f>; 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/par_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>

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



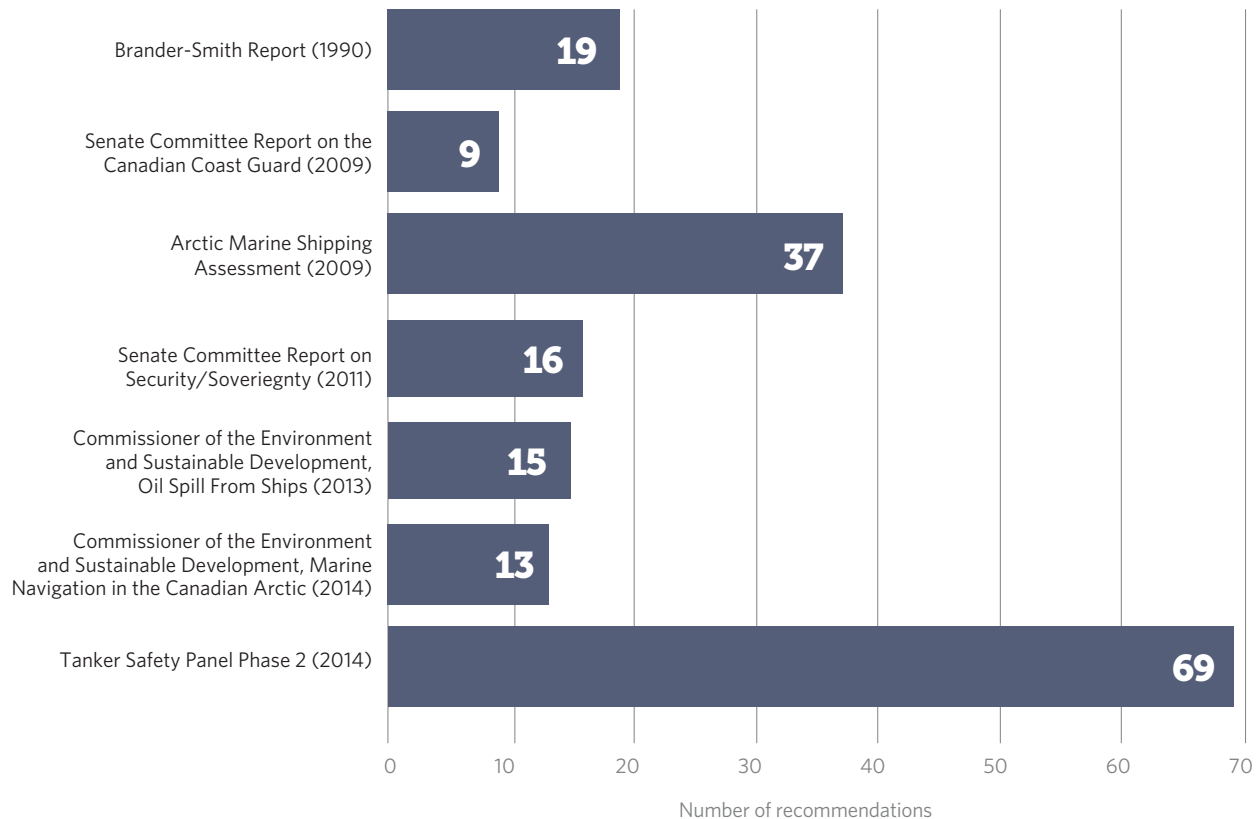
Sources: Canadian Ice Service, Ice Graph application, <http://iceweb1.cis.ec.gc.ca/IceGraph/page1.xhtml?lang=en>; Canadian Coast Guard, "NORDREG 1980-2015 Shipping Summary" (Arctic vessel traffic data from Jean-Pierre Lehnert at Canadian Coast Guard Base Iqaluit, Nov. 7, 2015)

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Figure 2

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

Numbers of recommendations



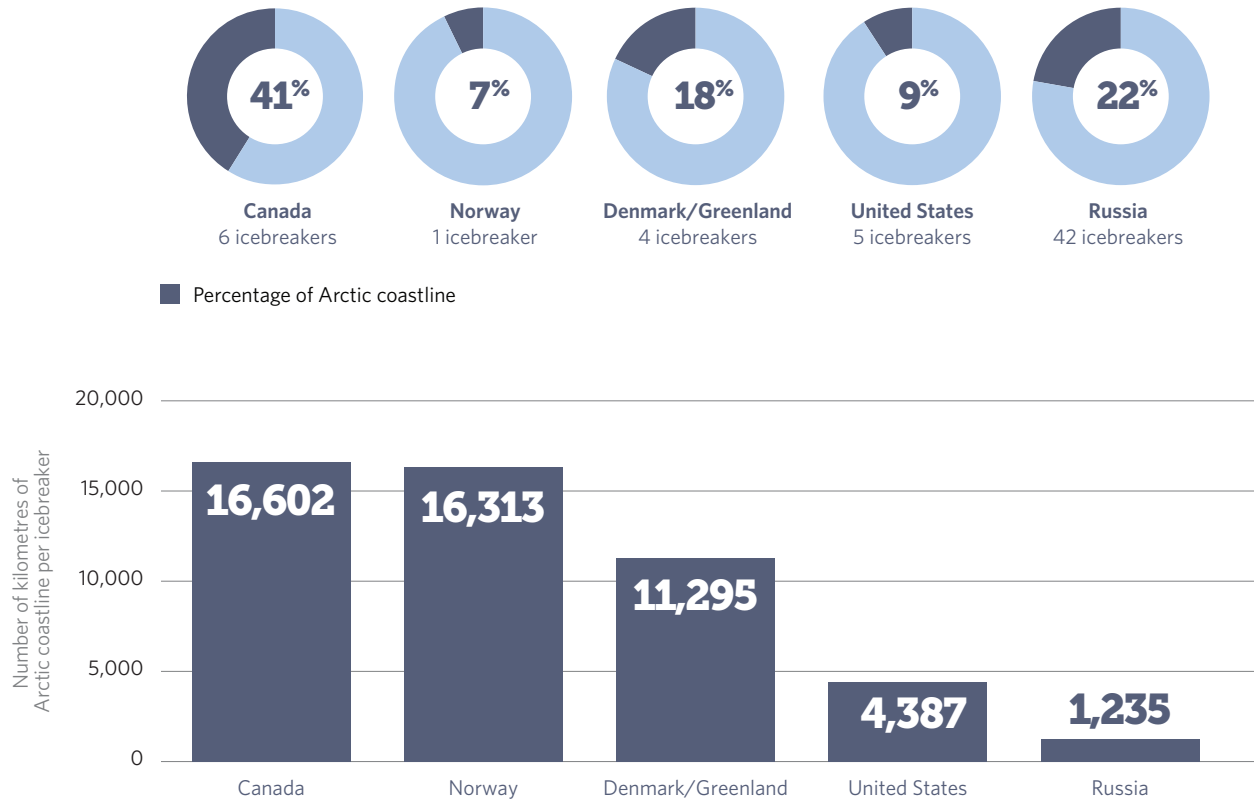
Sources: David Brander-Smith et al., *Protecting Our Waters*, Public Review Panel on Tanker Safety and Marine Spills Response Capability, Minister of Supply and Services Canada (September 1990), https://books.google.com/books/about/Protecting_our_waters.html?id=GTISAAAAYAAJ; Senate of Canada Standing 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/mospr/TC-Tanker-E-P2.pdf>

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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

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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

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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>

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

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