LIBRARY OF PARLIAMENT
BIBLIOTHÈQUE DU PARLEMENT

BACKGROUND PAPER

THE ARCTIC: ENVIRONMENTAL ISSUES

Publication No. 2020-92-E

3 December 2020

Thai Nguyen

Parliamentary Information and Research Service

AUTHORSHIP

3 December 2020 Thai Nguyen Economics, Resources and International Affairs Division

ABOUT THIS PUBLICATION

Library of Parliament Background Papers provide in-depth studies of policy issues. They feature historical background, current information and references, often anticipating the emergence of the issues they examine. They are prepared by the Parliamentary Information and Research Service, which carries out research for and provides information and analysis to parliamentarians and Senate and House of Commons committees and parliamentary associations in an objective, impartial manner.

This publication was prepared as part of the Library of Parliament's research publications program, which includes a set of publications, introduced in March 2020, addressing the COVID-19 pandemic. Please note that, because of the pandemic, all Library of Parliament publications will be released as time and resources permit.

The Arctic: Environmental Issues
(Background Paper)

Publication No. 2020-92-E

Ce document est également publié en français.

CONTENTS

EXECUTIVE SUMMARY

Climate change, changes in biological diversity, and the accumulation of toxic substances are three main interrelated issues affecting the rapidly shifting Arctic environment. While these issues, with climate change as a dominant driver, are largely the result of human activities in distant southern regions, they have serious cultural, socio-economic and health impacts on residents of the Arctic, especially on many Indigenous peoples, as well as adverse effects on the wildlife of the region.

Further action, both in Canada and internationally, will be needed to conserve and protect the Arctic environment.

THE ARCTIC: ENVIRONMENTAL ISSUES*

1 INTRODUCTION

Although the Arctic contains few large-scale industrial development projects and the region is sparsely populated, it is under threat from environmental stresses largely originating in distant southern regions. Three main interrelated issues are affecting the Arctic environment: climate change, changes in biological diversity and the accumulation of toxic substances. The Arctic appears to be both a harbinger of environmental change and a key determinant of that change, particularly as it relates to climate.

This Background Paper briefly describes some of the environmental issues impacting the Arctic and lists some of the efforts being made internationally and in Canada to protect and conserve the Arctic environment.

2 CLIMATE CHANGE

Anthropogenic climate change (brought about by human activity) is caused by greenhouse gases (GHGs) accumulating in the atmosphere, which is largely the result of fossil fuel use since the Industrial Revolution and of deforestation caused by land use changes. These gases trap heat in the atmosphere that would otherwise escape into space.

In 2014, the Intergovernmental Panel on Climate Change (IPCC) concluded in its Fifth Assessment Report that "[w]arming of the climate system is unequivocal, and since the 1950s, many of the observed changes are unprecedented over decades to millennia."[1] The report also indicated that increased emissions of GHGs, together with other anthropogenic drivers, are extremely likely to have been the dominant cause of the observed warming.

While there is uncertainty related to the effects, they are expected to be significant, including sea-level rise and increases in the frequency and intensity of extreme weather events and wildfires. The Arctic is warming twice as fast as the rest of the globe, and the consequences are already affecting the lives of the people of the region.[2] Permafrost is degrading, damaging the limited infrastructure, including roads, buildings and pipelines; animal ranges are changing, making hunting and fishing for traditional foods more difficult; and sea ice loss is drawing increased interest to resources in the Arctic Ocean while making sea ice roads, used as transportation highways by Inuit, unsafe.[3]

2.1 IMPACTS OF CLIMATE CHANGE ON THE ARCTIC

While the average global temperature has increased by about 1.2°C since 1880, Arctic temperatures, while highly variable, have increased overall at approximately twice this rate. Between 1948 and 2016, the estimate of mean annual temperature increase is 1.7°C for Canada as a whole and 2.3°C for the Canadian Arctic.[4] Predictions regarding Arctic climate change include a 4°C to 5°C increase above late 20th-century values before the middle of this century.

The impacts of climate change on the Arctic were first assessed specifically in Canada by Inuit Tapiriit Kanatami, Laval University and the National Aboriginal Health Organization,[5] and throughout the circumpolar Arctic by the Arctic Council, a high-level intergovernmental forum established in 1996 to provide a means for cooperation and coordination among the Arctic states.[6] The Arctic Council's seminal 2004 Arctic Climate Impact Assessment[7] was further elaborated upon in the IPCC's 2007 and 2014 reports in the context of the effects of climate change on the Arctic and Antarctic regions.[8] The following are some of the conclusions contained in the IPCC reports:

- The environmental impacts of climate change show profound regional differences, both within and between the polar regions.
- Climate change impacts on the food security, health and well-being of Arctic residents are serious and projected to increase, especially for many Indigenous peoples.
- A less severe Arctic climate will produce economic benefits for some communities.
- Changes to snow, water, ice and permafrost have a significant impact on Arctic freshwater and near-shore marine systems.
- The retreat of Arctic sea ice over recent decades[9] has led to improved marine shipping access in some parts of the Arctic but has the potential to make shipping more hazardous in Canada's Northwest Passage.[10] Changes in coastal ecology and biological production, adverse effects on many ice-dependent marine mammals and increased coastal erosion have also been noted.
- Future climate change in the polar regions will produce feedback effects that will have globally significant consequences over the next 100 years.

Following a process similar to that used by the IPCC, the Canadian government updated its 2004 assessment of climate change impacts and adaptation in Canada in 2008 and 2019. Many of the conclusions in the Canadian assessments reflect the 2007 and 2014 IPCC findings.[11]

2.2 IMPACTS OF A CHANGING ARCTIC ON GLOBAL CLIMATE

While climate change is clearly affecting the Arctic, its impacts in the region may also in turn accelerate global warming. The three mechanisms most often discussed are decreasing reflectivity of Earth (albedo), changing ocean circulation and releases of carbon from thawing permafrost.

Changes to Earth's reflectivity may occur as climate warming reduces the extent of sea ice, which reflects light, thereby increasing areas of darker open water. These areas absorb light and heat the water at the same time. This process increases the rate of ice loss, creating a continuous loop of cause and effect, known as a positive feedback, in which the results of a warming Arctic may amplify global climate change, which will in turn increase effects in the Arctic.[12]

Ocean currents and the global movement of water (circulation) regulate global weather and climate. Water density, a key determinant of ocean circulation, is a function of both temperature and salinity – the colder or saltier the water, the denser it is. Density-driven circulation occurs because cold and salty northern waters sink, while warmer tropical waters rise, creating a kind of conveyor belt of circulation. An appreciable influx of warmer, less dense fresh water – from melting glaciers and increased precipitation likely caused by climate change in the Arctic – has been measured. Should it continue or increase, it could alter oceanic circulation. In addition, the potential large-scale melting of the Greenland Ice Sheet, which holds 10% of the world's fresh water, would raise sea levels by 5 cm to 33 cm by 2100.[13]

The soils of the Arctic contain a vast store of carbon. While research is continuing to understand the dynamics of thawing permafrost and releases of this stored carbon, some scientists believe that the amount of carbon released from thawing permafrost could exceed current human carbon emissions. A warming Arctic, therefore, could accelerate global climate change by increasing carbon releases from Arctic soils.[14]

3 CHANGES IN BIOLOGICAL DIVERSITY

The people of the Arctic are heavily reliant, both for food and for social and cultural reasons, on the variety and abundance of organisms (biodiversity) in their region. According to the Millennium Ecosystem Assessment, completed in 2005, "biodiversity benefits people through more than just its contribution to material welfare and livelihoods. Biodiversity contributes to security, resiliency, social relations, health, and freedom of choices and actions."[15] Biodiversity is changing dramatically in the Arctic, the result of global habitat loss in wintering and staging grounds used by migratory species, and, most significantly, climate change.[16]

Changes in biodiversity in the Arctic are expected to be widespread, as detailed below.

3.1 INSECTS

The range of insect species, usually determined by climatic factors, may move northward into previously inhospitable areas.

3.2 BIRDS

The Arctic is a breeding ground for many migratory birds that overwinter elsewhere throughout the world. Climate change should favour the migration of bird species to more northerly locations. However, habitat loss and changes in food availability may also affect some of these species.[17]

3.3 MARINE LIFE

Reductions in the extent and thickness of sea ice are predicted to alter the seasonal distributions, geographic ranges, migration patterns, nutritional status, reproductive success and abundance of Arctic marine mammals. For instance, many species inhabiting regions covered by seasonal sea ice, such as seals and walruses, rely directly on suitable ice for resting, foraging, pupping and moulting.

Fish populations may be affected by increases in the productivity of algae and changes to the distribution of predators.

Regional warming may extend the range of certain species of fish. As sea ice conditions change, commercial fishing access and available species will expand in the Arctic. The increasing abundance and wider geographic occurrence of Pacific salmon in the Canadian Arctic is a tangible example.[18]

3.4 TERRESTRIAL LIFE

The Arctic treeline, the northernmost point that trees can grow, is moving northward as tundra is converted into forest under more favourable climate conditions, although the rate at which this is happening is difficult to measure, and factors other than temperature have an influence.

The thawing of permafrost could convert large areas of well-drained lands into wetlands.

Mosses and lichens, which constitute a key winter food for caribou and reindeer, could become less abundant as vascular plants (higher and more evolved plants, including flowering plants, conifers and ferns) become more prominent. Some species of herbivores with wide dietary flexibility could expand from the boreal forest to Arctic tundra. Alternatively, other herbivores, notably some caribou populations that are already under stress, might be negatively influenced by insects, extreme weather events and forage availability.

As southern species expand northward, resident species are forced to compete for habitat and resources. For example, the red fox has expanded northward into the habitats of the smaller Arctic fox, threatening the survival of the latter. Hybridization may occur more often, changing the genetic makeup of species.

4 ACCUMULATION OF TOXIC SUBSTANCES

Wind and ocean currents carry persistent chemicals, many of which are toxic, to the Arctic. Local mining and oil development could increase the chemical load in the Arctic. Increased marine shipping as a result of climate change will expose the Arctic to a greater risk of pollution. In addition, radioactive waste – much of it the result of Cold War activities in the former Soviet Union – is found in the Arctic.

The accumulation of toxic compounds in the Arctic threatens the health of the people and wildlife of the region. Pollutants that persist in the environment and accumulate in tissue (persistent organic pollutants, or POPs) are of particular concern in the Arctic because they are carried in the atmosphere and oceans, ending up in the food that people eat, such as whale fat. POPs include such compounds as polychlorinated biphenyls (PCBs), dichlorodiphenyltrichloroethane (DDT) and some organophosphate pesticides. Other contaminants include heavy metals such as mercury, which also persist in the environment.

Many toxic substances accumulate in fat, and animals with long lifespans tend to have high levels of chemical contaminants in fatty tissues. Because these contaminants become more concentrated as they move up the food chain, top predators, such as polar bears and wolves, acquire the highest concentrations. Arctic Indigenous peoples, who depend on local wildlife for sustenance, have daily intakes of toxic substances that can be 10 times higher than is tolerable, and such pollutants pass through blood and breast milk to the fetuses and children of affected adults.[19]

More recently recognized POPs include polybrominated flame retardants, such as polybrominated diphenyl ether (PBDE); perfluorinated compounds, such as perfluorooctane sulfonate (PFOS), used in stain repellents; and perfluorooctanoic acid (PFOA), used in non-stick coatings.[20]

The levels of some POPs have been decreasing in the region due to regulations introduced before and after the entry into force of the *Stockholm Convention on Persistent Organic Pollutants* in 2004. However, climate change and melting sea ice could affect the transport and release of legacy POPs with the potential for these contaminants to be reintroduced into Arctic aquatic food webs.[21]

5 INTERNATIONAL AND DOMESTIC INITIATIVES

5.1 INTERNATIONAL INITIATIVES

The sources of environmental issues in the Arctic lie mainly outside the region. While the effects of climate change are felt most strongly in the Arctic, the GHG emissions that contribute to climate warming are generated around the globe. POPs are produced outside the Arctic but, through atmospheric and oceanic circulation, arrive in the Arctic, where they accumulate in the food chain.

International initiatives are therefore essential to address environmental issues in the Arctic. Currently, there is no single comprehensive legal regime governing the Arctic that compares to the Antarctic Treaty System. It has been suggested that it is not only difficult to craft a new treaty for the Arctic because of the presence of sovereign nations (unlike in the Antarctic), but also unnecessary, since there are already a substantial number of international agreements in place that are relevant to the Arctic – such as the *United Nations Convention on the Law of the Sea* – although few are explicitly aimed at Arctic issues.[22] Other multilateral agreements pertinent to the region include the *United Nations Framework Convention on Climate Change* (UNFCCC), the *Convention on Biological Diversity* and the aforementioned Stockholm Convention. The five Arctic coastal nations (Canada, Denmark, Norway, Russia and the United States) stated in the 2008 Ilulissat Declaration that there was "no need to develop a new comprehensive international legal regime to govern the Arctic Ocean."[23]

The Arctic states have stressed cooperation through the Arctic Council. This organization is largely focused on assessing environmental threats but, under its auspices in 2013, member states concluded a legally binding agreement on preparedness and response to marine oil pollution in the Arctic.[24] There have been calls from Arctic parliamentarians for the Arctic Council to enhance environmental cooperation in light of the UNFCCC *Paris Agreement*. At its 2016 biennial meeting in Russia, the Conference of Parliamentarians of the Arctic Region recommended that the member states of the Arctic Council take new initiatives to reduce emissions of GHGs and short-lived climate pollutants, such as black carbon.[25]

Environmental governance of the Arctic goes beyond the Arctic Council. In 2018, the five Arctic coastal states and five other parties with significant commercial fishing industries (China, the European Union, Iceland, Japan and South Korea) signed the *International Agreement to Prevent Unregulated High Seas Fisheries in the Central Arctic Ocean*.[26] This agreement is based on a precautionary approach to future commercial fishing activities that recognizes the rapid climate change happening in the Arctic. It was also the first international treaty that included Indigenous knowledge in the decision-making process.[27]

On 20 November 2020, the International Maritime Organization approved a draft prohibition on the use and carriage for use as fuel of heavy fuel oil (HFO) by ships in Arctic waters on and after 1 July 2024.[28] Final adoption of the ban is expected in 2021. HFO is a term used to define a class of fuels that tend to have a higher viscosity and level of impurities compared to lighter and more refined fuels, such as liquid natural gas (LNG) or gasoline. Research has found that HFO spills account for approximately 60% of ship-source oil spills worldwide and are up to 50 times more toxic to fish than medium and light crude oils. In addition to its toxicity, HFO breaks down slowly in the marine environment, especially in cold climate regions, making clean-up of spills very difficult.

5.2 DOMESTIC INITIATIVES

While international initiatives are important to the management of the Arctic environment, Arctic countries can also play an active role through domestic initiatives. Canada has policies and legislation that affect the Arctic, including its 2019 Arctic and Northern Policy Framework.[29]

Prior to the United Nations (UN) Climate Change Conference that took place in Paris in 2015, Canada indicated that it would reduce its GHG emissions by 30% compared to 2005 levels, and that it would do so by 2030. Since then, the Canadian government has indicated it will introduce "new GHG reducing measures to exceed Canada's 2030 emissions reduction goal, and [begin] work so that Canada can achieve net-zero emissions by 2050."[30] Canada's plan to meet its target is laid out in the Pan-Canadian Framework on Clean Growth and Climate Change. According to the UN Environment Programme, with its current policies, Canada's emissions in 2030 are still expected to be 15% or more above its target projection.[31] On 19 November 2020, the federal government put forward Bill C-12, the Canadian Net-Zero Emissions Accountability Act. Bill C-12 requires that national targets for the reduction of GHG emissions in Canada be set, with the objective of attaining net-zero emissions by 2050.[32]

Canada's chief legislation for the protection of biodiversity is the 2002 *Species at Risk Act* (SARA). Several animal species with habitat in the Arctic are affected by this legislation. For example, the polar bear is listed as a species of special concern, some populations of Peary and barren-ground caribou are listed as endangered, and most populations of beluga whales are listed as endangered or threatened. The government has had difficulties implementing SARA, particularly with respect to identifying critical habitat for aquatic species and for species with very wide ranges, such as the boreal population of the woodland caribou. In addition, while SARA recognizes the inherent value of Indigenous knowledge, research has found that there has been no evidence of Indigenous involvement for most species' recovery planning.[33]

Canada protects habitat through its national parks and its network of protected areas, including Migratory Bird Sanctuaries, National Wildlife Areas and Marine Wildlife Areas under the *Canada Wildlife Act*, as well as Marine Protected Areas under the *Oceans Act*. Support for community-based stewardship programs also aims to protect biodiversity while fostering food sovereignty and a conservation economy in the Arctic. As part of the $1.5-billion Oceans Protection Plan[34] and in partnership with Inuit communities, the federal government is developing a Low Impact Shipping Corridors framework. This framework aims to identify shipping routes throughout the Arctic where the necessary infrastructure, marine navigational support and emergency response services should be provided to support safe shipping and protect culturally significant marine areas.[35]

Canada's Chemicals Management Plan,[36] released in December 2006, has been funded in three phases, with the final phase sunsetting in March 2021. Under the plan, the *Canadian Environmental Protection Act, 1999* is being used to review thousands of chemicals on the Domestic Substances List initially screened for potential toxicity as a statutory requirement of the Act. The aim of the reviews is to establish whether any of the targeted substances pose risks. Through the plan, for example, Canada was the first country to complete a risk assessment of a common chemical used in the manufacture of some plastics (bisphenol A) and to conclude that it poses a risk to young children and the environment and therefore requires control. Newer POPs, such as most PBDEs and PFOAs, are also being addressed.

Canada also has legislation relating specifically to the Arctic, the *Arctic Waters Pollution Prevention Act*, which prohibits the deposit of waste in Arctic waters or any place where such waste might enter Arctic waters. In 2009, the federal government extended its application in Arctic waters from 100 nautical miles to 200 nautical miles (approximately 185 kilometres to 370 kilometres). In 2018, Canada introduced new *Arctic Shipping Safety and Pollution Prevention Regulations*.[37] The regulations incorporate the *International Code for Ships Operating in Polar Waters* (the Polar Code) into domestic legislation. The Polar Code addresses the unique hazards encountered by vessels that operate in the Arctic and Antarctic by requiring a variety of safety and pollution prevention measures, including those related to vessel design and equipment.[38]

The federal government is responsible for abandoned mines and other contaminated sites north of 60° latitude. The Commissioner of the Environment and Sustainable Development, in his March 2008 report, stated that the federal government had made progress toward its ultimate goal of eliminating by 2020 the $3.1-billion liability recorded up to that point in connection with its contaminated sites. However, the remoteness of some of the northern sites has made contamination difficult to address.[39] In 2019, the federal budget allocated $2.2 billion over 15 years to create the Northern Abandoned Mine Reclamation Program.[40] The program manages the remediation of

eight abandoned mines in Yukon and the Northwest Territories. The remaining sites in the Arctic are managed under the Northern Contaminated Sites Program and are funded through Environment and Climate Change Canada's Federal Contaminated Sites Action Plan.[41]

6 CONCLUSION

Three main environmental issues are apparent in the Arctic: climate change, changes in biodiversity and the accumulation of toxic substances. Climate change is an overriding factor, affecting all aspects of life in the Arctic, yet the GHG emissions responsible for recent warming in the region emanate from industrial activity and land use changes far removed from the region. Biodiversity changes are largely the result of climate change but are also caused by habitat changes elsewhere in wintering zones and along migratory pathways. Toxic substances, which travel thousands of kilometres from their origins in the south, are building up in the food chain.

International action is therefore necessary to address environmental concerns that have far-reaching cultural, socio-economic and health impacts in the Arctic. Multilateral cooperation has been focused on the Arctic Council, but domestic initiatives also play an important role in the management of the Arctic environment. Whether it is on the international scene or domestically, Indigenous peoples of the Arctic have been providing an increasingly significant contribution to environmental management decisions. In fact, large portions of the Canadian Arctic are co-managed by Inuit and federal, provincial and territorial governments through devolution and land and resource management regimes established by five comprehensive Inuit–Crown land claims agreements.[42]

NOTES

* This Background Paper is based on an earlier publication of the same name: Tim Williams, *The Arctic: Environmental Issues*, Publication no. 2008-04, Parliamentary Information and Research Service, Library of Parliament, Ottawa, 2012.

1. Intergovernmental Panel on Climate Change, *Climate Change 2014: Synthesis Report – Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*, Synthesis report, Geneva, Switzerland, 2015, p. 2.
2. James Overland et al., "The urgency of Arctic change," *Polar Science*, Vol. 21, September 2019.
3. Okalik Eegeesiak, "The Arctic Ocean and the Sea Ice Is Our Nuna," *UN Chronicle*.
4. Xuebin Zhang et al., "Changes in Temperature and Precipitation Across Canada," Chapter 4 in *Canada's Changing Climate Report*, eds. E. Bush and D. S. Lemmen, Government of Canada, Ottawa, 2019, p. 116.
5. Communities of Ivujivik, Puvirnituq and Kangiqsujuaq, C. Furgal, S. Nickels and Kativik Regional Government – Environment Department, *Unikkaagatigiit: Putting the Human Face on Climate Change – Perspectives from Nunavik Communities*, Joint publication of Inuit Tapiriit Kanatami, Nasivvik Centre for Inuit Health and Changing Environments at Université Laval and the Ajunnginiq Centre at the National Aboriginal Health Organization, Ottawa, 2005.

6. The Arctic Council is a high-level intergovernmental forum involving all eight Arctic states – Canada, Denmark, Finland, Iceland, Norway, Russia, Sweden and the United States – as well as Arctic Indigenous organizations. It provides a means for promoting environmental protection and sustainable development in the Arctic. See Thai Nguyen and Tim Williams, *The Arctic: Organizations Involved in Circumpolar Cooperation*, Publication no. 2008-15-E, Parliamentary Information and Research Service, Library of Parliament, Ottawa, 20 May 2016.

7. Arctic Monitoring and Assessment Programme, *Arctic Climate Impact Assessment (ACIA)*.

8. J. N. Larsen et al., "Polar Regions," Chapter 28 in *Climate Change 2014: Impacts, Adaptation, and Vulnerability – Part B: Regional Aspects – Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*, eds. V. R. Barros et al., Cambridge University Press, Cambridge, United Kingdom, and New York, 2014, pp. 1567–1612.

9. The retreat of sea ice has accelerated in recent years. The greatest observed loss of sea ice extent recorded since 1979 (the first year of the satellite record) was in 2012. Much of the ice that is disappearing is long-term multi-year ice, which melts far less readily than ice formed within the previous year.

10. Northwest Territories, "7.3: Trends in shipping in the Northwest Passage and the Beaufort Sea," *NWT State of the Environment Report*, 29 May 2015.

11. S. Cohen et al., "Changes in Canada's Regions in a National and Global Context," Chapter 8 in *Canada's Changing Climate Report*, eds. E. Bush and D. S. Lemmen, Government of Canada, Ottawa, 2019, pp. 424–443.

12. Dmitry Yumashev et al., "Climate policy implications of nonlinear decline of Arctic land permafrost and other cryosphere elements," *Nature Communications*, Article 1900, Vol. 10, 23 April 2019.

13. Andy Aschwanden et al., "Contribution of the Greenland Ice Sheet to sea level over the next millennium," *Science Advances*, Vol. 5, No. 6, 19 June 2019.

14. Merritt R. Turetsky et al., "Carbon release through abrupt permafrost thaw," *Nature Geoscience*, Vol. 13, 3 February 2020, pp. 138–143. [SUBSCRIPTION REQUIRED]

15. World Resources Institute, "Key Messages," *Ecosystems and Human Well-being: Biodiversity Synthesis*, Washington, D.C., 2005.

16. CAFF [Conservation of Arctic Flora and Fauna], *Arctic Biodiversity Assessment: Report for Policy Makers*, Akureyri, Iceland, 2013, pp. 9–10.

17. Paul A. Smith et al., "Status and trends of tundra birds across the circumpolar Arctic," *Ambio*, Vol. 49, March 2020, pp. 732–748.

18. K. M. Dunmall et al., "Pacific Salmon in the Arctic: Harbingers of Change," in *Responses of Arctic Marine Ecosystems to Climate Change*, eds. F. J. Mueter et al., Alaska Sea Grant, University of Alaska Fairbanks, 2013.

19. Jennifer Gibson et al., "Levels and trends of contaminants in humans of the Arctic," *International Journal of Circumpolar Health*, Vol. 75, No. 1, 13 December 2016.

20. United Nations Environment Programme [UNEP], *The new POPs under the Stockholm Convention*.

21. Marie Noël, Lisa L. Loseto and Gary Stern, "Legacy contaminants in the eastern Beaufort Sea beluga whales (*Delphinapterus leucas*): are temporal trends reflecting regulations?," *Arctic Science*, Vol. 4, No. 3, 12 February 2018.

22. Hans Corell, Ambassador and Former Under-Secretary General for Legal Affairs and the Legal Counsel of the United Nations, "Reflections on the possibilities and limitations of a binding legal regime for the Arctic," Address to the Seventh Conference of Parliamentarians of the Arctic Region, Kiruna, Sweden, 3 August 2006.

23. Canada–Europe Parliamentary Association, "Appendix 2: The Ilulissat Declaration – Arctic Ocean Conference, Ilulissat, Greenland, 27 – 29 May 2008," *Report of the Canadian Parliamentary Delegation on the Eighth Conference of Parliamentarians to the Arctic Region, Fairbanks, Alaska, 12-14 August, 2008*.

24. Arctic Council, *International Cooperation in the Arctic*.

25. Canada–Europe Parliamentary Association, "Appendix 2: Conference of Parliamentarians of the Arctic Region – The Standing Committee of Parliamentarians of the Arctic Region," *Report of the Canadian Parliamentary Delegation respecting its participation at the 12th Conference of Parliamentarians of the Arctic Region, Ulan-Ude, Russia, 14–16 June 2016*.

26. Fisheries and Oceans Canada, *International Agreement to Prevent Unregulated High Seas Fisheries in the Central Arctic Ocean*.

27. Senate, Special Committee on the Arctic, "The Arctic in a Global Context," Chapter 4 in *Northern Lights: A Wake-Up Call for the Future of Canada*, Report, June 2019, p. 94.

28. International Maritime Organization [IMO], *Marine Environment Protection Committee (MEPC) 75, 16–20 November (virtual session)*. [2020]

29. Government of Canada, *Canada's Arctic and Northern Policy Framework*.

30. Government of Canada, *Progress towards Canada's greenhouse gas emissions reduction target*.

31. UNEP, *Emissions Gap Report 2019*, 2019, p. 15.

32. Bill C-12, An Act respecting transparency and accountability in Canada's efforts to achieve net-zero greenhouse gas emissions by the year 2050, 2nd Session, 43rd Parliament.

33. Cassandra J. Hill, Richard Schuster and Joseph R. Bennett, "Indigenous involvement in the Canadian species at risk recovery process," *Environmental Science & Policy*, Vol. 94, April 2019, pp. 220–226. [SUBSCRIPTION REQUIRED]

34. Transport Canada, *Canada's Oceans Protection Plan*.

35. Jackie Dawson et al., "Infusing Inuit and local knowledge into the Low Impact Shipping Corridors: An adaptation to increased shipping activity and climate change in Arctic Canada," *Environmental Science & Policy*, Vol. 105, March 2020, pp. 19–36. [SUBSCRIPTION REQUIRED]

36. Information on the Chemicals Management Plan is available at Government of Canada, *Chemical Substances*.

37. *Arctic Shipping Safety and Pollution Prevention Regulations*, SOR/2017-286.

38. IMO, *International Code for Ships Operating in Polar Waters (Polar Code)*.

39. Office of the Auditor General of Canada, *Chemicals Management – Federal Contaminated Sites*, Chapter 3 in *2008 March Status Report of the Commissioner of the Environment and Sustainable Development*, March 2008.

40. Government of Canada, *Northern Abandoned Mine Reclamation Program*.

41. Government of Canada, *Action plan for contaminated sites*.

42. Inuit Tapiriit Kanatami, *Arctic and Northern Policy Framework: Inuit Nunangat*, 2019, p. 1.