

Management Plan for the Polar Bear (*Ursus maritimus*) in Canada

Polar Bear



2025



Government
of Canada

Gouvernement
du Canada

Canada

Recommended citation:

Environment and Climate Change Canada. 2025. Management Plan for the Polar Bear (*Ursus maritimus*) in Canada [Proposed]. *Species at Risk Act* Management Plan Series. Environment and Climate Change Canada, Ottawa. 5 parts. Part 1: 61 pp.; Part 2: vii + 66 pp.; Part 3: 63 pp.; Part 5A: 14 pp.; Part 5B: vii + 54 pp.; Part 6: 77 pp.

Official version

The official version of the recovery document is the one published in PDF. All hyperlinks were valid as of date of publication.

Non-official version

The non-official version of the recovery document is published in HTML format and all hyperlinks were valid as of date of publication.

For copies of the management plan, or for additional information on species at risk, including the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) Status Reports, residence descriptions, action plans, and other related recovery documents, please visit the [Species at Risk \(SAR\) Public Registry](#)¹.

Cat. No.:

ISBN:

EC

Content (excluding the illustrations) may be used without permission for non-commercial purposes, with appropriate credit to the source.

Unless otherwise specified, you may not reproduce materials in this publication, in whole or in part, for the purposes of commercial redistribution without prior written permission from Environment and Climate Change Canada's copyright administrator. To obtain permission to reproduce Government of Canada materials for commercial purposes, apply for Crown Copyright Clearance by contacting:

Environment and Climate Change Canada
Public Information Centre
Place Vincent Massey building
351 St-Joseph boulevard
Gatineau Quebec K1A 0H3
Toll free: 1-800-668-6767
Email: enviroinfo@ec.gc.ca

¹ www.canada.ca/en/environment-climate-change/services/species-risk-public-registry.html

35

36 **Cover illustration:** © David McGeachy (Environment and Climate Change Canada)

37

38 © His Majesty the King in Right of Canada, represented by the Minister of Environment
39 and Climate Change, 2025. All rights reserved.

40

41 Également disponible en français sous le titre

42 « Plan de gestion de l'ours blanc (*Ursus maritimus*) au Canada [Proposition] »

MANAGEMENT PLAN FOR THE POLAR BEAR (*Ursus maritimus*) IN CANADA

2025

Under the Accord for the Protection of Species at Risk (1996), the federal, provincial and territorial governments agreed to work together on legislation, programs, and policies to protect wildlife species at risk throughout Canada.

In the spirit of cooperation of the Accord, the relevant jurisdictions (Governments of Yukon, Northwest Territories, Nunavut, Ontario, and Québec²), and the relevant Wildlife Management Boards (WMB), Advisory Councils and Indigenous governments within these jurisdictions, have given permission to the Government of Canada to adopt their management plans or recovery strategies for the Polar Bear (*Ursus maritimus*) (Parts 2, 3, 5 and 6) under Section 69 of the *Species at Risk Act* (SARA). Environment and Climate Change Canada has included a federal addition (Part 1) which completes the SARA requirements for this management plan. Once prepared by the Governments of Manitoba and Newfoundland and Labrador, their Polar Bear Recovery Strategies or Management Plans will be adopted as Parts 4 and 7 of the Federal Management Plan for Polar Bear in Canada (hereafter the Federal Management Plan).

The Federal Management Plan for the Polar Bear (*Ursus maritimus*) in Canada consists of seven parts:

Part 1 – Canada:

Federal Addition to the *Management Plan for the Polar Bear (Ursus maritimus) in Canada*, prepared by Environment and Climate Change Canada

Part 2 – Inuvialuit Settlement Region:

Inuvialuit Settlement Region Polar Bear Joint Management Plan 2017, prepared by the Joint Secretariat Inuvialuit Settlement Region

Part 3 – Nunavut:

Nunavut Polar Bear Co-Management Plan, prepared by the Nunavut Polar Bear Co-Management Working Group

Part 4 – Manitoba:

Recovery Strategy for the Polar Bear (*Ursus maritimus*) in Manitoba

Document will be inserted and adopted as Part 4 of the Federal Management Plan once transmitted to Environment and Climate Change Canada by Manitoba

² The Government of Quebec is not signatory to the Accord for the Protection of Species at Risk (1996). However, the Government of Quebec does cooperate with the federal government in the conservation of species at risk of common interest.

84 Part 5 – Ontario:

85 Part A: *Polar Bear – Ontario Government Response Statement*, prepared by the Ontario
86 Ministry of Natural Resources and Forestry (2016) (species-specific policy)

87 Part B: *Recovery Strategy for Polar Bear (Ursus maritimus) in Ontario*, prepared by
88 M.B. Tonge and T.L. Pulfer (2011) (technical advice)

89
90 Part 6 – Québec-Eeyou Marine Region-Nunavik Marine Region:

91 *Management Plan for the Polar Bear (Ursus maritimus) for Québec, the Eeyou Marine*
92 *Region and the Nunavik Marine Region*, prepared by the Québec - Eeyou Marine
93 Region - Nunavik Marine Region Polar Bear Working Group

94
95 Part 7 – Newfoundland and Labrador:

96 Management Plan for the Polar Bear (*Ursus maritimus*) in Newfoundland and Labrador
97 Document will be inserted and adopted as Part 7 of the Federal Management Plan once
98 transmitted to Environment and Climate Change Canada by Newfoundland and
99 Labrador

100

Table of Contents

Part 1 – Federal Addition to the *Management Plan for the Polar Bear (Ursus maritimus)* in Canada, prepared by Environment and Climate Change Canada

Preface	2
Acknowledgments	4
Additions and Modifications to the Adopted Documents	6
1. COSEWIC Species Assessment Information	7
2. Species Status Information	8
3. Species Information	9
3.1 Species Description	9
3.2 Species Population and Distribution	11
3.3 Needs of the Species	15
4. Threats	16
4.1 Threat Assessment	16
4.2 Description of Threats	19
5. Management Objective	29
6. Broad Strategies and Conservation Measures	30
6.1 Actions Already Completed or Currently Underway	30
6.2 Broad Strategies	40
6.3 Conservation Measures	40
7. Measuring Progress	45
8. References	46

Part 2 – *Inuvialuit Settlement Region Polar Bear Joint Management Plan*, prepared by the Joint Secretariat Inuvialuit Settlement Region

Part 3 – *Nunavut Polar Bear Co-Management Plan*, prepared by the Nunavut Polar Bear Co-Management Working Group

Part 4 – Recovery Strategy for the Polar Bear (*Ursus maritimus*) in Manitoba

Part 5A – *Polar Bear – Ontario Government Response Statement*, prepared by the Ontario Ministry of Natural Resources and Forestry (2016) (species-specific policy)

Part 5B – *Recovery Strategy for Polar Bear (Ursus maritimus) in Ontario*, prepared by M.B. Tonge and T.L. Pulfer (2011) (technical advice)

Part 6 – *Management Plan for the Polar Bear (Ursus maritimus) for Québec, the Eeyou Marine Region and the Nunavik Marine Region*, prepared by the Québec – Eeyou Marine Region - Nunavik Marine Region Polar Bear Working Group

Part 7 – Management Plan for the Polar Bear (*Ursus maritimus*) in Newfoundland and Labrador

140

141

142

143

144

145

146

147

148

149

150

**Part 1 – Federal Addition to the *Management Plan for the
Polar Bear (Ursus maritimus) in Canada*, prepared by
Environment and Climate Change Canada**

Preface

The federal, provincial, and territorial government signatories under the [Accord for the Protection of Species at Risk \(1996\)](#)³ agreed to establish complementary legislation and programs that provide for effective protection of species at risk throughout Canada⁴. Under the [Species at Risk Act \(S.C. 2002, c.29\)](#) (SARA)⁵, the federal competent ministers are responsible for the preparation of management plans for listed species of special concern and are required to report on progress within five years after the publication of the final document on the Species at Risk Public Registry.

The Minister of Environment and Climate Change and Minister responsible for the Parks Canada Agency is the competent minister under SARA for the Polar Bear and has prepared the federal component of this management plan (Part 1), as per section 65 of SARA. To the extent possible, it has been prepared in cooperation with the relevant jurisdictions (Governments of Yukon, Northwest Territories, Nunavut, Ontario and Québec), Indigenous governments and organizations⁶, Wildlife Management Boards/Advisory Councils⁷, and other co-management partners within the range of Polar Bear in Canada as per section 66(1) of SARA. SARA section 69 allows the competent minister to adopt all or part of an existing plan for the species if the competent minister is of the opinion that an existing plan relating to wildlife species includes adequate measures for the conservation of the species. The Governments of Yukon, Northwest Territories, Nunavut, Ontario, and Québec provided the attached management plans and recovery strategy for the Polar Bear (Parts 2, 3, 5, and 6). The Province of Ontario also led the development of the attached Government Response Statement (Part 5A), which is the Ontario Government's policy direction on Polar Bear. This policy summarizes the prioritized actions that the Ontario Government intends to take and support in response to the provincial recovery strategy. The Polar Bear Recovery Strategy for Manitoba and Management Plan for Newfoundland and Labrador will be adopted as Parts 4 and 7, respectively, of the Federal Management Plan once they are transmitted to Environment and Climate Change Canada. This Federal Addition to the Federal Management Plan consists of the adoption of the jurisdictional recovery documents for the entire Designatable Unit in Canada.

Success in the conservation of this species depends on the commitment and cooperation of many different constituencies that will be involved in implementing the directions set out in this plan and will not be achieved by Environment and Climate Change Canada and the Parks Canada Agency, or any other jurisdiction alone. All

³ www.canada.ca/en/environment-climate-change/services/species-risk-act-accord-funding.html#2

⁴ The Province of Quebec is not signatory of the Accord for the Protection of the species at Risk (1996). It does, however, cooperate with the federal government in the conservation of species at risk of common interest.

⁵ <https://laws.justice.gc.ca/eng/acts/S-15.3/index.html>

⁶ Makivik Corporation, Nunavut Tunngavik Inc., Cree Nation Government, Nunatsiavut Government, and the Inuvialuit Game Council

⁷ Wildlife Management Advisory Council (NWT) and Wildlife Management Advisory Council (North Slope), Nunavut Wildlife Management Board, Nunavik Marine Region Wildlife Board, Eeyou Marine Region Wildlife Board, Torngat Wildlife and Plants Co-Management Board

188 members of the public are invited to join in supporting and implementing this plan for the
189 benefit of the species and society as a whole. Implementation of this management plan
190 is subject to appropriations, priorities, and budgetary constraints of the participating
191 jurisdictions and organizations.
192

Acknowledgments

Lauren Schmuck (Wildlife Management and Regulatory Affairs Division [WMRAD], Wildlife Management Directorate [WMD], Canadian Wildlife Service [CWS]) led the preparation of the Federal Addition (Part 1) to the Federal Management Plan.

The contributions of Caroline Ladanowski (WMRAD, WMD, CWS), Ryan Zimmerling (formerly WMRAD, WMD, CWS), Sam Iverson (formerly WMRAD, WMD, CWS), Peter Hale (formerly WMRAD, WMD, CWS), Véronique Brondex (Species at Risk Implementation Division [SARID], WMD, CWS), Matthew Huntley (SARID, WMD, CWS), Thomas Calteau (formerly SARID, WMD, CWS), April Patmanathan (SARID, WMD, CWS), Cecilia Loughheed (International Biodiversity Division, Biodiversity Policy and Partnerships Directorate, CWS), Gina Schalk (SARID, WMD, CWS), Teresa Tufts (formerly Northern Region, Regional Operations Directorate [ROD], CWS), Diana Ghikas (Prairie Region, ROD, CWS), Ken Tuininga (formerly Ontario Region, ROD, CWS), Mark Mills (Québec Region, ROD, CWS), Paul MacDonald (Atlantic Region, ROD, CWS), Nick Lunn, Evan Richardson and Dominique Henri (Wildlife Research Division, Wildlife and Landscape Science Directorate, Science & Technology Branch), Joanne Tuckwell (Conservation Programs Branch, Protected Areas Establishment and Conservation Directorate, Parks Canada Agency), Scott Chiu (Aquatic Ecosystems, Biodiversity Management, Species at Risk Program, Fisheries and Oceans Canada), Karine Robert (Ecosystem Science, Fish Population Science, Ecosystems and Oceans Science, Fisheries and Oceans Canada), and the Marine Mammal Science Branch, Ecosystem and Ocean Sciences sector, Ecosystems Science Directorate of Fisheries and Oceans Canada are acknowledged and appreciated.

Environment and Climate Change Canada appreciates the input of the Wildlife Management Boards, Advisory Councils, and Inuit, Inuvialuit, Cree and First Nation individuals across the species' range. Environment and Climate Change Canada has, to the extent possible, attempted to integrate the Indigenous Knowledge shared by Inuit, Inuvialuit and Cree, alongside scientific knowledge, to develop this Management Plan.

Environment and Climate Change Canada would like to express its gratitude to the Working Group of organizations on the Polar Bear Administrative Committee (PBAC) for their guidance and input on the development of the first draft of the Federal Addition (Part 1) of the Federal Management Plan. In addition, gratitude is extended to the following Indigenous, provincial, territorial and federal organizations for their insightful comments and collaboration throughout the development of this document:

- Inuvialuit Game Council
- Wildlife Management Advisory Council (North Slope)
- Government of Yukon
- Wildlife Management Advisory Council (Northwest Territories)
- Government of Northwest Territories
- Nunavut Wildlife Management Board

- 234 - Nunavut Tunngavik Incorporated
- 235 - Government of Nunavut
- 236 - Government of Manitoba
- 237 - Government of Ontario
- 238 - Makivik Corporation
- 239 - Nunavik Marine Region Wildlife Board
- 240 - Eeyou Marine Region Wildlife Board
- 241 - Gouvernement du Québec
- 242 - Torngat Wildlife, Plants and Fisheries Secretariat
- 243 - Nunatsiavut Government
- 244 - Government of Newfoundland and Labrador
- 245 - Parks Canada Agency

246 Lastly, the contributions of the individuals, non-governmental organizations, Indigenous
247 organizations, scientists and various interest groups who provided guidance, comments
248 and recommendations to improve this Management Plan during the consultation
249 processes are acknowledged.

Additions and Modifications to the Adopted Documents

The following sections have been included to address specific requirements of the federal *Species at Risk Act* (SARA) that may not be addressed in the jurisdictional management plans or recovery strategies for the Polar Bear (*Ursus maritimus*): Parts 2, 3, 5 and 6 of this document, (referred to henceforth as “the jurisdictional management plans or recovery strategies”), and/or to provide updated or additional information. Parts 4 (Manitoba) and 7 (Newfoundland and Labrador) will be inserted and adopted into the Federal Management Plan when they are transmitted to Environment and Climate Change Canada.

Under SARA, prohibitions regarding the protection of species and their habitat do not apply to species of special concern. Conservation measures in the jurisdictional management plans dealing with the protection of individuals and their habitat are adopted to guide conservation efforts but would not result in legislative/regulatory protection under SARA.

1. COSEWIC* Species Assessment Information

Assessment Summary – November 2018⁸

Common name

Polar Bear

Scientific name

Ursus maritimus

Status

Special Concern

Reason for designation

This apex predator depends on the availability of sea ice from which to hunt its preferred prey—ice-adapted seals. Reduction in the area and period of sea ice coverage due to climate warming in the Canadian Arctic, with consequent reductions in feeding opportunity, is the primary threat to the persistence of this species. However, the magnitude of the impact on population numbers is uncertain and will vary across the range. Population levels and trends are currently uncertain, as population estimates undertaken since the last COSEWIC assessment in 2008 exist for less than half of the range and survey methodology has changed. This precludes the use of quantitative trend analysis for most of the Canadian population. The total population in Canada likely exceeds 10,000 mature individuals. ATK indicates stable or increasing populations in all 13 management units, while scientific knowledge suggests a decline associated with poorer body condition, decreasing productivity, and sea ice decline in three management units in the southern part of the range. The Canadian population is predicted to decline over the next three generations (35 years) due to a reduction in seasonal coverage of sea ice. This species may become Threatened in the future because the effects of sea ice loss on this species will be extensive and ongoing.

Occurrence

Yukon, Northwest Territories, Nunavut, Manitoba, Ontario, Québec, Newfoundland and Labrador, Arctic Ocean.

Status history

Designated Not at Risk in April 1986. Status re-examined and designated Special Concern in April 1991. Status re-examined and confirmed in April 1999, November 2002, April 2008, and November 2018.

* COSEWIC (Committee on the Status of Endangered Wildlife in Canada), ATK (Aboriginal Traditional Knowledge).

⁸ The November 2018 COSEWIC Species Assessment Information is taken directly from the 2018 COSEWIC Assessment and Status Report on the Polar Bear *Ursus maritimus* in Canada.

2. Species Status Information

It is estimated that approximately 60% of the global population of the Polar Bear is found in Canada (Wiig et al. 2015; Obbard et al. 2010). The International Union for the Conservation of Nature (IUCN) has ranked the Polar Bear as globally Vulnerable (A3c) due to the potential for large reductions in the global Polar Bear population if the losses in sea ice extent and quality measured over the last several decades continue as forecast (Wiig et al. 2015). International, national, provincial and territorial NatureServe rankings for the Polar Bear are captured in Table 1, below.

Table 1. List and description of NatureServe* rankings for the Polar Bear.

Region:	Status:
Global	G3 (Vulnerable)
Canada	N3
Yukon	S1
Northwest Territories	S2S3
Nunavut	S3
Manitoba	S2
Ontario	S3
Québec	S2
Newfoundland and Labrador	S2S3

* The NatureServe rankings for the Polar Bear are designated by a number from 1 to 5, preceded by a letter reflecting the appropriate geographic scale of the assessment (G = Global, N = National, and S = Subnational). The numbers have the following meaning: 1 = critically imperiled, 2 = imperiled, 3 = vulnerable, 4 = apparently secure, 5 = secure.

In Canada, the Polar Bear was designated as a species of special concern by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) in 1991 and the special concern status was confirmed by COSEWIC in 1999, 2002, 2008 and 2018 (COSEWIC 2018). Polar Bear was listed as a species of special concern under the *Species at Risk Act* by the Government of Canada in 2011 (SOR/2011-23). The special concern listing does not impose automatic federal prohibitions – management of Polar Bears in Canada will continue as it was prior to the listing. A special concern listing does, however, trigger the development of a federal Management Plan, which is intended to provide guidance to prevent the Polar Bear from becoming a threatened or endangered species. A Management Plan lays out the actions that are required to prevent any further decline of the species. The federal, provincial, and territorial government signatories under the Accord for the Protection of Species at Risk (1996) agreed to establish complementary legislation and programs that provide for effective protection of species at risk throughout Canada. Table 2 provides a summary of provincial and territorial government designations for the Polar Bear.

Table 2. List and description of various conservation status designations for the Polar Bear in Canada.

Province/Territory	Legislation	Designation	Year
Yukon	<i>Yukon Wildlife Act</i>	No status	–
Northwest Territories	<i>Species at Risk (NWT) Act</i>	Special Concern	2014
Nunavut	<i>Nunavut Wildlife Act</i>	Not listed	-
Manitoba	<i>Endangered Species Act</i>	Threatened	2008
Ontario	<i>Endangered Species Act, 2007</i>	Threatened	2009
Québec	<i>Loi sur les espèces menacées ou vulnérables</i>	Vulnérable ⁹	2009
Newfoundland & Labrador	<i>Endangered Species Act</i>	Vulnerable ¹⁰	2002

The Polar Bear is listed within Appendix II of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) and has been listed since CITES came into effect in 1975. This means that any international shipment of Polar Bears or parts thereof requires an export permit from the country of origin (Government of Canada, 2017a). In Canada, CITES is implemented by the federal government through the *Wild Animal and Plant Protection and Regulation of International and Interprovincial Trade Act* (WAPPRITA). For more information on CITES and WAPPRITA, please refer to section 6.

3. Species Information

3.1 Species Description

The Polar Bear is a large carnivorous mammal that inhabits both terrestrial and marine areas and occurs in Canada, Greenland, Norway (Svalbard), Russia, and the United States. Polar Bears are apex predators, and they occupy the highest trophic levels in arctic marine ecosystems (Thiemann et al. 2008). In the wild, female Polar Bears can live up to 30 years, and male Polar Bears can live up to 25 years (Cohen 2004). Females generally produce litters of one or two cubs at a time, though triplets are occasionally born (Ramsay and Stirling, 1988). In most areas, females care for cubs during the first two and a half years of their cubs' life, which means females are capable of mating once every three years (Stirling 2011).

While some genetic differences exist between Polar Bears found throughout Canada, COSEWIC concluded that these differences do not meet the criteria for dividing the Canadian Polar Bear population into multiple Designatable Units (DUs) (COSEWIC 2018). For management purposes, the global Polar Bear population is divided into

⁹ Equivalent to Special Concern under SARA

¹⁰ Equivalent to Special Concern under SARA

20 subpopulations, 14 of which occur in whole or in part in Canada (see Figure 1, below). These 14 subpopulations are considered to comprise the single DU in Canada (COSEWIC, 2018). Abundance inventories are conducted and status and trend is monitored at a subpopulation level. Thirteen of Canada's 14 subpopulations are actively managed by Canadian authorities, whereas the Arctic Basin subpopulation, which lies to the north of any permanent settlements, is not actively managed. The federal addition to the Federal Management Plan applies to Canada's Polar Bear Designatable Unit as a whole.

For additional information pertaining to the ecology and natural history of the Polar Bear, please refer to Parts 2 – 7 of this Management Plan.

3.2 Species Population and Distribution

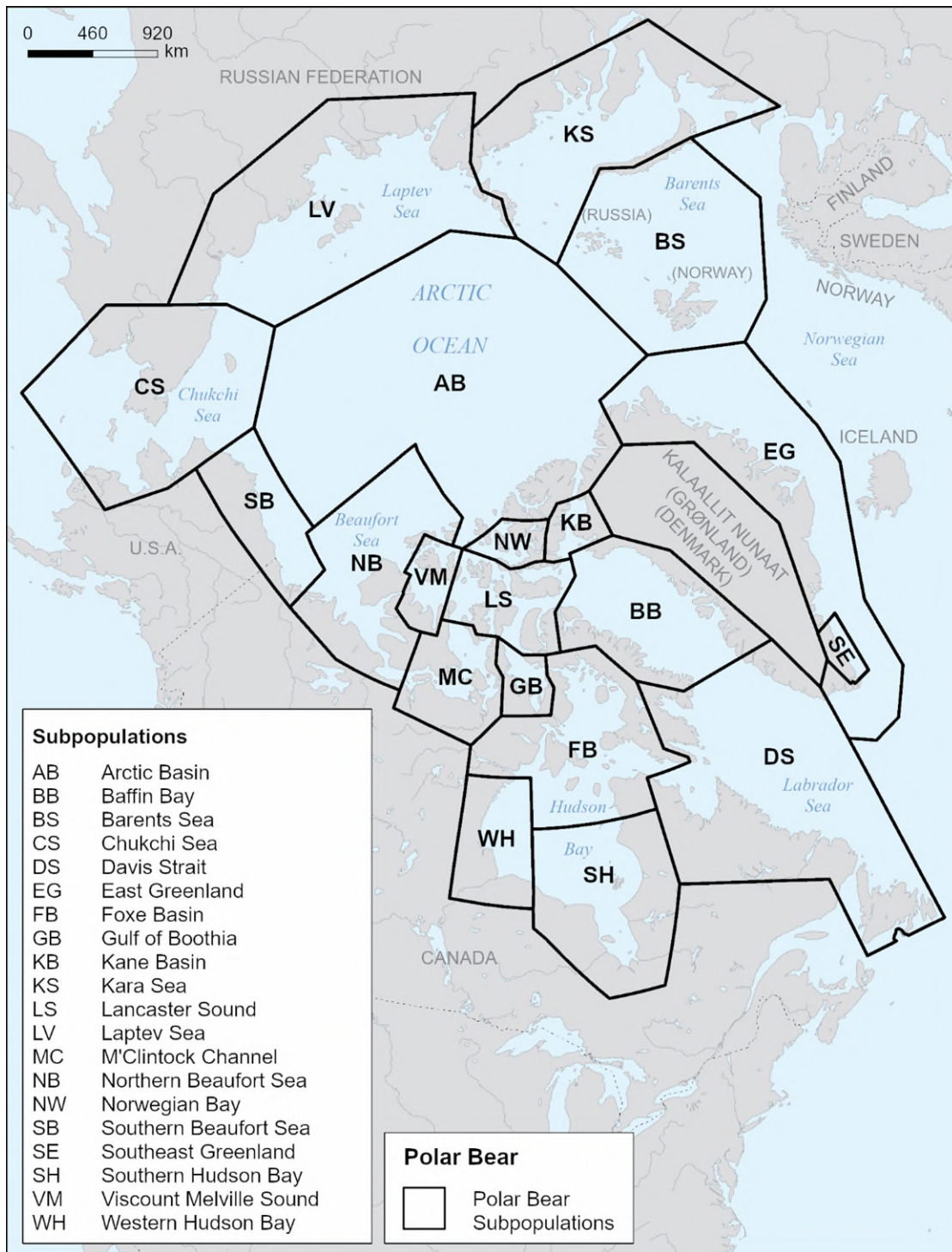


Figure 1: Global Polar Bear subpopulations (source: Polar Bear Subpopulation Boundaries IUCN/SSC Polar Bear Specialist Group (2024))

Canada is home to approximately 16,000¹¹ of the estimated 20,000 – 26,000 Polar Bears found throughout the circumpolar arctic. Subpopulation surveys are conducted according to a pre-determined schedule of studies, with an objective of obtaining updated abundance estimates every 5 to 15 years. It is not logistically feasible to survey all subpopulations concurrently and some subpopulations have not been surveyed in >15 years. As such, it is difficult to generate a precise estimate of the overall abundance of Polar Bear in Canada.

The boundaries of Polar Bear subpopulations in Canada are delineated based on the best available scientific and Indigenous Knowledge related to the movements and genetics of Polar Bears, as well as management considerations (Figure 1) (Lunn et al. 2010). The term “subpopulation”, as used in this document, is consistent with its use by the International Union for the Conservation of Nature (IUCN)/Species Survival Commission (SSC) Polar Bear Specialist Group (PBSG), and Canada’s Polar Bear Technical Committee (PBTC) (for more information on the PBTC, please refer to section 6.1). The term subpopulation as applied to Polar Bear has the same meaning as the term “management unit” as used in COSEWIC assessment and status reports for the species.

In Canada, Polar Bear management is a shared responsibility of federal, provincial and territorial governments, Wildlife Management Boards/Advisory Councils, and Land Claim Organizations that represent Indigenous rights holders. With respect to government regulation, provinces and territories have authority over Polar Bears on provincial and territorial lands. The federal government has authority on federal lands, such as National Parks and National Wildlife Areas. Offshore areas in Canada are generally under federal authority, however, within Indigenous land claim settlement areas that encompass both land and sea (Inuvialuit Settlement Area, Nunavut, Nunatsiavut), provincial and territorial authorities exercise management actions, such as the determination and enforcement of harvest levels, that have application onshore and offshore, in accordance with treaty and land claims processes.

Organizations with management authority for Polar Bears in Canada, including federal, provincial and territorial governments, Wildlife Management Boards/Advisory Councils and Land Claim Organizations that represent Indigenous rights holders, work together to manage Polar Bears in Canada. More information about Canada’s domestic conservation and management of Polar Bears can be found in section 6.1 of this document.

Most of the Polar Bear range in Canada occurs within areas where modern Crown-Indigenous Land Claims Agreements are in place. Within these Land Claims Areas, Total Allowable Take/Harvest levels are determined in processes that flow through Wildlife Management Boards/Advisory Councils. Table 3 enumerates the relevant Wildlife Management Boards/Advisory Councils or other similar entities for

¹¹ The estimate of a Canadian population of 16,000 Polar Bears is a summation of the most recent estimates for each subpopulation. This sum was reached by adding the abundance estimates for each subpopulation from the most recent PBTC status table (2020).

each subpopulation, as well as the federal, provincial and territorial governments to which Polar Bear harvest management decisions or recommendations are currently forwarded. The jurisdictional plans in Parts 2-7 of this Management Plan (noted in Table 3) provide additional information regarding Polar Bear subpopulations throughout Canada and provide jurisdiction-specific management objectives and actions.

Table 3. Canadian Polar Bear subpopulations and the management authorities that currently share decision-making responsibility.

Subpopulation	Wildlife Management Boards, Advisory Councils and Other Similar Entities ^a	Canadian Federal, Provincial and Territorial Management Authorities	Foreign Governments and other Co-Management Partners	Corresponding Jurisdictional document(s):
Arctic Basin ^b (AB)	NWMB, IGC, WMAC (NWT)	Nunavut, Northwest Territories	Greenland, Norway, Russia and the United States	See Parts 2 and 3 of this document
Baffin Bay (BB)	NWMB	Nunavut	Greenland	See Part 3 of this document
Davis Strait (DS)	NWMB, NMRWB, HFTCC, TWPCB	Canada, Nunavut, Québec, Newfoundland and Labrador	Greenland	See Parts 3, 6 and 7 of this document
Foxe Basin (FB)	NWMB, NMRWB, HFTCC	Canada, Nunavut, Québec	None	See Parts 3 and 6 of this document
Gulf of Boothia (GB)	NWMB	Nunavut	None	See Part 3 of this document
Kane Basin (KB)	NWMB	Nunavut	Greenland	See Part 3 of this document
Lancaster Sound (LS)	NWMB	Nunavut	None	See Part 3 of this document
M'Clintock Channel (MC)	NWMB	Nunavut	None	See Part 3 of this document
Northern Beaufort Sea (NB)	NWMB, IGC, WMAC (NWT)	Nunavut, Northwest Territories	None	See Parts 2 and 3 of this document
Norwegian Bay (NW)	NWMB	Nunavut	None	See Part 3 of this document
Southern Beaufort Sea (SB)	IGC, WMAC (NWT), WMAC (NS)	Northwest Territories, Yukon	United States, Iñupiat	See Parts 2 and 3 of this document

Subpopulation	Wildlife Management Boards, Advisory Councils and Other Similar Entities ^a	Canadian Federal, Provincial and Territorial Management Authorities	Foreign Governments and other Co-Management Partners	Corresponding Jurisdictional document(s):
Southern Hudson Bay (SH)	NWMB, NMRWB, EMRWB, HFTCC	Canada, Nunavut, Québec, Ontario	None	See Parts 3, 5 and 6 of this document
Viscount Melville Sound (VM)	NWMB, IGC, WMAC (NWT)	Nunavut, Northwest Territories	None	See Parts 2 and 3 of this document
Western Hudson Bay (WH)	NWMB	Nunavut, Manitoba, Ontario	None	See Parts 3, 4 and 5 of this document

^a Abbreviations. EMRWB: Eeyou Marine Region Wildlife Management Board; HFTCC: James Bay and Northern Québec Agreement (JBNQA) Hunting, Fishing and Trapping Coordinating Committee; IGC: Inuvialuit Game Council; NMRWB: Nunavik Marine Region Wildlife Management Board; NWMB: Nunavut Wildlife Management Board; TWPCB: Torngat Wildlife and Plants Co-Management Board; WMAC-NS: Wildlife Management Advisory Council – North Slope; WMAC (NWT): Wildlife Management Advisory Council - Northwest Territories.

^b Note that there is no active monitoring or management in the Arctic Basin subpopulation

The status of Canada's Polar Bear subpopulations is updated by the Polar Bear Technical Committee when new information is available, and information pertaining to subpopulation status can be found on the [Polar Bear Administrative Committee's website¹²](#). For more information pertaining to the Polar Bear Administrative Committee and the Polar Bear Technical Committee, please refer to section 6.1 of Part 1 of this Management Plan.

Indigenous peoples and Polar Bear:

In Canada, the Polar Bear has and continues to play an integral role in the social, cultural, and economic lives of northern Indigenous peoples. The species is intricately linked to the traditions of northern Indigenous peoples who have harvested the Polar Bear for thousands of years and valued the species for both consumptive and non-consumptive purposes (COSEWIC 2018). The Polar Bear has been a principal feature in cultural and traditional forms of expression and imagination including mythology, spirituality, storytelling, art, and song (Saladin 1990; Joint Secretariat 2017).

¹² www.polarbearsCanada.ca/en/polar-bears-canada/canadas-polar-bear-subpopulations

Indigenous peoples recognize the Polar Bear for its importance in preserving cultural identity and connection to the environment (Species at Risk Committee 2021). The act of hunting is essential for building and fostering human-animal and human-human relationships (Dowsley and Wenzel 2008), promoting a sense of community through celebration, social gathering and storytelling, in addition to sharing food from the hunt (Slavik 2013). The Polar Bear has been used for subsistence in many northern communities through the consumption of meat (Slavik 2010; Wenzel 2011; Freeman and Wenzel 2006). In addition to the subsistence and cultural importance of Polar Bear, the hides, teeth, claws, bones, and skulls from a harvested Polar Bear are used for clothing, mattresses, tools, household items and medicine, in addition to being sold as artifacts and crafts. Due to the economic value of the species, Polar Bear hides, teeth, claws, bones and skulls may also enter the commercial trade (Slavik 2013; Peacock et al. 2011; Kendrick 2013). The continued hunting of the Polar Bear is an essential part of the identity, values, livelihood, and culture of northern Indigenous peoples in Canada.

3.3 Needs of the Species

In Canada, Polar Bears rely on both marine (sea ice) and terrestrial habitat to meet their life history requirements. Their area of occupancy includes landfast, offshore pack ice, maritime coastlines with a preference for areas over the continental shelf and terrestrial areas (within 50 kilometers of the coast and up to 120 kilometers in some cases) of Labrador, Québec, Ontario, Manitoba, Nunavut, Northwest Territories, and Yukon (COSEWIC 2018). This range encompasses regions where sea ice melts completely each summer (known as annual sea ice); areas where sea ice forms along the shore and then retreats during summer, but remains offshore; and areas where locally formed or transported ice remains year-round (known as convergent or archipelago sea ice) (Atwood et. al 2016). Some Polar Bears are also known to frequent multi-year ice, and some have also been observed traveling long distances in-land between ocean bays (Joint Secretariat 2015). Within each of these ice ecoregions, the productivity of Polar Bear habitat is closely linked to the physical attributes of sea ice and the density and distribution of ice-dependent seals, especially Ringed seals (*Pusa hispida*) (Stirling et al. 1997; Stirling 2002; Pilfold et al. 2015).

The relationship between Polar Bears, sea ice, and prey (primarily Ringed and Bearded seals) is extremely complex, involving ice conditions, type (such as multi-year and annual ice, and local conditions like pressure ridges, open leads, and rubble ice), thickness, and location (SARC 2021). Polar Bear locations, body condition, and productivity are closely and complexly related to ice conditions, ocean productivity, and seals, and they must be understood in the context of large interannual variation (SARC 2021).

For additional information pertaining to the biology, ecological role and habitat needs of the Polar Bear, please refer to Parts 2 – 7 of this Management Plan.

4. Threats

4.1 Threat Assessment

The Polar Bear threat assessment is based on the IUCN-CMP (International Union for Conservation of Nature-Conservation Measures Partnership) unified threats classification system (Salafsky et al. 2008). Threats are defined as the proximate activities or processes that have caused, are causing, or may cause in the future the destruction, degradation, and/or impairment of the entity being assessed (population, species, community, or ecosystem) in the area of interest (global, national, or subnational). Limiting factors are not considered during this assessment process. In this threat assessment, only present and future threats (over the next 10 years) are considered. Historical threats, indirect or cumulative effects of the threats, or any other relevant information that would help understand the nature of the threats are presented in the Description of Threats section.

The threat assessment for Polar Bear (below) was conducted in April 2018, and was led by COSEWIC. Polar Bear co-management partners (e.g. federal, provincial and territorial governments, Wildlife Management Boards/Advisory Councils, Indigenous governments, Indigenous organizations, and University researchers) throughout Canada were represented. The threat assessment pertains to the single Polar Bear Designatable Unit in Canada, as defined by COSEWIC, and was developed using the best available information.

530 **Table 4.** Threat calculator assessment¹³ (based on the version 3.2 of the IUCN-CMP threats
531 classification).

Threat #	Threat description	Impact ^a	Scope ^b	Severity ^c	Timing ^d
1	Residential & Commercial Development	Negligible	Negligible (<1%)	Extreme (71-100%)	High (Continuing)
1.1	Housing & Urban areas	Negligible	Negligible (<1%)	Extreme (71-100%)	High (Continuing)
1.2	Commercial & Industrial areas	Negligible	Negligible (<1%)	Extreme (71-100%)	Insignificant/Negligible (past or no direct effect)
3	Energy Production & Mining	Negligible	Negligible (<1%)	Extreme (71-100%)	Low (possibly in the long term, >10 years/3 generations)
3.1	Oil & Gas Drilling	Negligible	Negligible (<1%)	Extreme (71-100%)	Low (possibly in the long term, >10 years/3 generations)
3.2	Mining & Quarrying	Negligible	Negligible (<1%)	Extreme (71-100%)	Low (Possibly in the long term, >10 years/3 generations)
4	Transportation & Service Corridors	Negligible	Small (1-10%)	Negligible (<1%)	Moderate (possibly in the short term, <10 years/3 generations)
4.1	Roads & Railroads	Negligible	Negligible (<1%)	Negligible (<1%)	Low (Possibly in the long term, >10 years/3 generations)
4.2	Utility & Service Lines	Negligible	Negligible (<1%)	Negligible (<1%)	Insignificant/ Negligible (Past or no direct effect)
4.3	Shipping Lanes	Negligible	Small (1 – 10%)	Negligible (<1%)	Moderate (Possibly in the short term, < 10 years/3 generations)
4.4	Flight Paths	Not a Threat	Negligible (<1%)	Neutral or Potential Benefit	High (Continuing)
5	Biological Resource Use	Low	Pervasive (71-100%)	Slight (1-10%)	High (continuing)
5.1	Hunting & Collecting Terrestrial animals	Low	Pervasive (71-100%)	Slight (1-10%)	High (Continuing)
6	Human Intrusions & Disturbance	Negligible	Restricted (11-30%)	Negligible (<1%)	High (continuing)
6.1	Recreational Activities	Negligible	Small (1 – 10%)	Negligible (<1%)	High (Continuing)
6.2	War, Civil Unrest, & Military Exercises	Negligible	Negligible (<1%)	Negligible (<1%)	High (Continuing)
6.3	Work & Other Activities	Negligible	Restricted (11 – 30%)	Negligible (<1%)	High (Continuing)

¹³ This threat calculator assessment is taken directly from the 2018 COSEWIC Assessment and Status Report on the Polar Bear *Ursus maritimus* in Canada.

Threat #	Threat description	Impact ^a	Scope ^b	Severity ^c	Timing ^d
7	Natural System Modifications	Unknown	Small (1 – 10%)	Unknown	High (continuing)
7.1	Fire & Fire Suppression	Not a threat	Negligible (<1%)	Neutral or Potential Benefit	High (Continuing)
7.2	Dams & Water Management/Use	Not a threat	Negligible (<1%)	Neutral or Potential Benefit	Low (Possibly in the long term, >10 years/3 generations)
7.3	Other Ecosystem Modifications	Unknown	Small (1 – 10%)	Unknown	High (Continuing)
8	Invasive & Other Problematic Species & Genes	Unknown	Pervasive – Large (31-100%)	Unknown	High (Continuing)
8.1	Invasive Non-Native/Alien Species	Unknown	Unknown	Unknown	High (Continuing)
8.2	Problematic Native Species/Diseases	Unknown	Pervasive – Large (31 – 100%)	Unknown	High (Continuing)
8.3	Introduced Genetic Material	Negligible	Small (1 – 10%)	Negligible (<1%)	High (Continuing)
9	Pollution	Low	Pervasive (71-100%)	Slight (1-10%)	High (Continuing)
9.1	Domestic & Urban Waste Water	Negligible	Negligible (<1%)	Unknown	High (Continuing)
9.2	Industrial & Military Effluents	Unknown	Small (1 – 10%)	Unknown	High (Continuing)
9.3	Agricultural & Forestry Effluents	Negligible	Negligible (<1%)	Unknown	High (Continuing)
9.4	Garbage & Solid Waste	Negligible	Small (1-10%)	Negligible (<1%)	High (Continuing)
9.5	Air-Borne Pollutants	Low	Pervasive (71 – 100%)	Slight (1-10%)	High (Continuing)
10	Geological Events	Negligible	Negligible (<1%)	Negligible (<1%)	High (Continuing)
10.3	Avalanches/Landslides	Negligible	Negligible (<1%)	Negligible (<1%)	High (Continuing)
11	Climate Change & Severe Weather	High	Pervasive (71-100%)	Serious (31-70%)	High (Continuing)
11.1	Habitat Shifting & Alteration	High	Pervasive (71 – 100%)	Serious (31-70%)	High (Continuing)
11.2	Droughts	Negligible	Negligible (<1%)	Unknown	Low (Possibly in the long term, >10 years/3 generations)
11.3	Temperature Extremes	Unknown	Small (1 – 10%)	Unknown	High (Continuing)
11.4	Storms & Flooding	Unknown	Unknown	Unknown	High – Low
11.5	Other Impacts	Unknown	Unknown	Unknown	Unknown

^a **Impact** – The degree to which a species is observed, inferred, or suspected to be directly or indirectly threatened in the area of interest. The impact of each threat is based on Severity and Scope rating and considers only present and future threats. Threat impact reflects a reduction of a species population or

decline/degradation of the area of an ecosystem. The median rate of population reduction or area decline for each combination of scope and severity corresponds to the following classes of threat impact: Very High (75% declines), High (40%), Medium (15%), and Low (3%). Unknown: used when impact cannot be determined (e.g., if values for either scope or severity are unknown); Not Calculated: impact not calculated as threat is outside the assessment timeframe (e.g., timing is insignificant/negligible or low as threat is only considered to be in the past); Negligible: when scope or severity is negligible; Not a Threat: when severity is scored as neutral or potential benefit.

^b **Scope** – Proportion of the species that can reasonably be expected to be affected by the threat within 10 years. Usually measured as a proportion of the species' population in the area of interest. (Pervasive = 71–100%; Large = 31–70%; Restricted = 11–30%; Small = 1–10%; Negligible < 1%).

^c **Severity** – Within the scope, the level of damage to the species that can reasonably be expected to be affected by the threat within a 10-year or three-generation timeframe. Usually measured as the degree of reduction of the species' population. (Extreme = 71–100%; Serious = 31–70%; Moderate = 11–30%; Slight = 1–10%; Negligible < 1%; Neutral or Potential Benefit ≥ 0%).

^d **Timing** – High = continuing; Moderate = only in the future (could happen in the short term [< 10 years or 3 generations]) or now suspended (could come back in the short term); Low = only in the future (could happen in the long term [> 10 years or 3 generations]) or now suspended (could come back in the long term); Insignificant/Negligible = only in the past and unlikely to return, or no direct effect but limiting.

4.2 Description of Threats

The information in section 4.2 is based on the “Threats” section of the COSEWIC Assessment and Status Report on the Polar Bear, which was published in fall 2019. For more information on Threats to Polar Bears in Canada, refer to parts 2 – 7 of this Management Plan.

The primary threats to Polar Bear in Canada include the following:

High Threat Categories:

Climate Change and Severe Weather (IUCN/CMP Threat # 11.1 – Habitat Shifting and Alteration):

The most significant threat facing the Canadian and global Polar Bear population is sea ice habitat loss resulting from increased atmospheric temperatures caused by global greenhouse gas emissions (Tynan and DeMaster 1997; Derocher et al. 2004; Laidre et al. 2008; Kovacs et al. 2010; IPCC 2013). Over the past 40 years, data from satellites have shown a decrease in arctic sea ice cover which is unparalleled in the past 150 years (Derksen et al. 2019). Inuvialuit Knowledge holders have observed intensifying effects of climate change on the ocean and weather since the 1980s. The forecasted continuation of these changes will result in sea ice habitat loss, likely leading to direct and indirect negative effects on Polar Bear body condition, adult and cub survival rates, reproductive success, distribution and abundance of prey, contaminant transfer, and habitat fragmentation (COSEWIC 2018). For example, declines in the recruitment of Ringed Seals (the primary prey of Polar Bears in many areas) have been noted and linked to warmer temperatures and decreasing snow depth (Ferguson et al.

2005). Declines in distribution and abundance of Ringed Seals will likely impact the ability of Polar Bears to harvest their primary prey (Stirling and Øritsland 1995; Hart and Amos 2004; Keith 2005; Joint Secretariat 2015; York *et al.* 2015).

Negative impacts of sea ice habitat loss have been recorded in several subpopulations, though considerable regional variability exists (Derksen *et al.* 2019). Based on current trends, it is expected that greenhouse gas emissions will continue to increase, leading to a decrease in sea ice habitat (Stern and Laidre 2016; Wiig *et al.* 2015). For example, in the Arctic Ocean, a substantial portion of the multiyear ice, which traditionally lasts for at least one complete summer melt season, has been replaced by seasonal first-year ice, the entirety of which melts during the summer (Derksen *et al.* 2019). Though climate change is widely believed to lead to decreased habitat availability for Polar Bears, some have hypothesized that areas in Canada's far north which are currently covered in thick multiyear ice may gradually convert to a largely seasonal/annual ice cover (Derocher *et al.* 2004). Sunlight is able to penetrate seasonal/annual ice to a larger extent than multiyear ice, and increased sunlight is likely to lead to greater biological productivity in the far north. Some research suggests that this conversion from multiyear ice to seasonal/annual ice cover may facilitate the development of conditions that are more suitable for Polar Bears than are currently present in northern subpopulations (Derocher *et al.* 2004; Stirling and Derocher 2012). In particular, an increase in the primary productivity of an ecosystem can lead to the formation of better ice habitat for Ringed Seals and other Polar Bear prey (Kingsley *et al.* 1985; Derocher *et al.* 2004; Arrigo *et al.* 2008; Barber *et al.* 2015). Some Indigenous Knowledge holders have indicated that a transition from multiyear ice to annual ice may benefit Polar Bears because annual ice provides better seal hunting platforms. Others suggest that Polar Bears may move north to follow multiyear ice (SARC 2021). Subpopulations with high proportions of multiyear sea ice, such as Norwegian Bay, M'Clintock Channel, and Lancaster Sound, may eventually experience this gradual shift from multiyear ice to a largely annual/seasonal ice cover (Stirling and Derocher 2012). This is further discussed below.

In seasonal ice environments, Polar Bears accumulate fat reserves to survive the ice-free season fasting period, and pregnant female Polar Bears must reach a body mass sufficient to sustain their survival during winter denning and lactation periods (Watts and Hansen 1987; Atkinson and Ramsay 1995; Robbins *et al.* 2012). During the spring hyperphagic¹⁴ period, Polar Bears forage in an effort to gain weight and improve body condition (Molnár *et al.* 2010, 2014; Pilfold *et al.* 2016a). However, during the ice-free season, research in Hudson Bay found that fasting adult males held at the Churchill holding facility experienced a median weight loss of approximately 1 kilogram per day (Pilfold *et al.* 2016a). These findings aligned with observations on fasting free-ranging bears on land (Atkinson *et al.* 1996, Polischuk *et al.* 2002). If foraging time is decreased as a result of sea ice loss due to climate change, this may lead to declines in body condition, which may affect Polar Bear survivorship, reproduction and abundance (Stirling and Archibald 1977; Stirling and Øritsland 1995; Stirling *et al.* 1999). Recent research on the Baffin Bay subpopulation supports this possibility. Earlier

¹⁴ A period of excessive food consumption (COSEWIC 2018).

spring retreat of sea ice and later reform in the fall has resulted in an extended ice-free season, which led Polar Bears in the Baffin Bay subpopulation to spend at least 30 more days on land between 2009 and 2015, as compared to the amount of time spent on land between 1991 and 1997. This extended ice-free season has also been associated with a corresponding reduction in body size and reproductive success among the Baffin Bay subpopulation (Laidre et al. 2020). However, Indigenous Knowledge holders have noted that despite significant changes in habitat conditions due to climate change, the impact of sea ice loss on Polar Bears is unclear, given the complexity of sea ice habitat (SARC 2021). Ice conditions are fundamentally important and are changing Polar Bear movements and range, but population and body condition have been observed to be stable over time in the Northern and Southern Beaufort Sea, notwithstanding considerable variation between seasons and years (JS 2015).

One empirical effect of climate change in arctic marine ecosystems has been the gradual replacement of multiyear ice with seasonal/annual sea ice, which melts completely during summer (Derksen et al. 2019). As discussed above, a transition from multiyear ice to predominantly seasonal/annual sea ice may lead to an increase in primary productivity and improved sea ice habitat. If this hypothesis is correct, it is reasonable to suggest that this change will, at least initially, benefit Polar Bears in subpopulations with high proportions of multiyear ice (Stirling and Derocher 2012). However, considerable uncertainty surrounds the ecological ramifications of the gradual replacement of multiyear ice with seasonal/annual sea ice in arctic ecosystems (COSEWIC 2018). Indigenous Knowledge is an excellent source of information on changes in Polar Bear distribution and feeding habits, and should be utilized to help determine the implications of such changes on Polar Bears. Over the long term, if sea ice loss continues, scientific evidence suggests that negative impacts are expected as outlined above.

If sea ice becomes increasingly fragmented, the temporal and spatial distribution of Polar Bear habitat may become compromised (Sahanatien and Derocher 2012). With changes in ice conditions leading to a loss of multiyear sea ice, it is hypothesized that the fidelity that some Polar Bears have shown to some specific regions may be disrupted (Schweinsburg and Lee 1982; Schweinsburg et al. 1982; Taylor et al. 2001). Changes in sea ice distribution and break-up timing can separate Polar Bears from important habitat such as the receding multiyear sea ice front, summer retreat habitat, and traditional denning areas in the spring and summer (COSEWIC 2018), and can delay Polar Bears from returning to sea ice in the fall/winter (Derocher et al. 2004; Durner et al. 2011; Pagano et al. 2012; Stirling and Derocher 2012; Laidre et al. 2020). In the Baffin Bay subpopulation, for example, it is hypothesized that sea ice loss is associated with seasonal range contraction (Laidre et al. 2008). Furthermore, Polar Bears have been observed to undertake more energy intensive long distance swims due to increased distance between pack and landfast ice, or as a result of sea ice fragmentation (Monnett and Gleason 2006; Molnár et al. 2007; Durner et al. 2011; Pagano et al. 2012; Pilfold et al. 2016b). The energetic demands created by long-distance swims may be a contributing factor to Polar Bear mortality, though there are currently no known cases of Polar Bear mortality occurring as a direct result of

drowning (Pagano et al. 2012). Mating opportunities (Molnár et al. 2007; Molnár et al. 2008) and access to foraging areas may also be reduced as a result of a loss of spatial connectivity of sea ice in the spring (COSEWIC 2018). Indigenous Knowledge holders have also noted changes in Polar Bear distribution, movements, and local abundance over time related to ice and weather conditions (SARC 2021). Because sea ice habitat is often naturally fragmented, it is important for Polar Bears to be able to swim long distances (Slavik et al. 2009). However, changes in sea ice habitat may put stress on their adaptability with potential impacts on their health and diet, range and movements (SARC 2021).

It is known that Polar Bears rely on the presence of sea ice platforms to enable them to capture their primary prey (i.e. Ringed seals) (Stern and Laidre 2016), however, more research is needed to fully understand the impacts of climate change on Polar Bears, and the extent to which climate change will amplify the other threats listed below. For example, while it has been hypothesized that Polar Bears may be able to adapt to a changing climate by shifting their diet to terrestrial-based food sources (COSEWIC 2018), considerable uncertainty exists surrounding the ability of Polar Bears to compensate for diminished access to marine food sources in this manner (Rode et al. 2015; Sciullo et al. 2016).

Given the unpredictable and variable nature of Polar Bear habitat, as well as the intelligence and adaptability of Polar Bears themselves, Indigenous Knowledge holders have emphasized the need for humility in understanding Polar Bears and their habitat, and the importance of not speculating about the future (Joint Secretariat 2015).

For more information on climate change-related initiatives being led by Environment and Climate Change Canada, please refer to the Broad Strategies, section 6. More information on climate change-related initiatives being led by provinces and territories can be found in parts 2 – 7 of this Management Plan.

Low Threat Categories:

Biological Resource Use (IUCN/CMP Threat # 5.1 – Hunting and Gathering Terrestrial Animals):

Polar Bear harvest is a legally-protected right of Indigenous people in Canada. In areas where Canada has concluded modern Land Claims Agreements, Polar Bear harvest quotas are determined or recommended by Wildlife Management Boards or Advisory Councils that include representatives from the Government of Canada, provincial or territorial governments, and Indigenous organizations/governments. Total Allowable Harvest levels (or harvest quotas) are currently in place throughout Nunavut, the Inuvialuit Settlement Region (Yukon and Northwest Territories) and Nunatsiavut (Newfoundland and Labrador) to manage for sustainable harvest. Within the Nunavik Marine Region and an overlap area between the Nunavik Marine Region and Eeyou Marine Region, which is offshore from Québec, a harvest quota has been established

by the Government of Canada and the Government of Nunavut for the Southern Hudson Bay subpopulation. In mainland (onshore) areas of Ontario, Manitoba and Québec, harvest management falls under the jurisdiction of the respective provinces. In Ontario, Treaty 9 does not set out a process for cooperative federal-provincial-Indigenous harvest management, and Indigenous implementation of provincial harvest limits is voluntary. In Manitoba, provincial legislation does not permit the harvesting of Polar Bear. In Québec, the James Bay and Northern Québec Agreement (JBNQA) sets out a guaranteed harvest level for subsistence requirements, subject to the principles of conservation.

Guided sport hunting is permitted in Nunavut and the Inuvialuit Settlement Region (ISR), via transfer of exclusive right, and in both jurisdictions local hunting and trapping organizations decide if they wish to allocate a portion of the quota to this practice. Guided sport hunting is closely regulated by Inuit communities and is part of the harvest management system mentioned above. In both jurisdictions, guided sport hunts must be conducted using traditional methods, including the use of dog sled teams as a means of transportation. In both jurisdictions, if a Polar Bear is successfully harvested, it counts against the quota. Therefore, the total number of Polar Bears that may be harvested as a result of guided sport hunting does not increase the overall harvest. Additionally, in the Inuvialuit Settlement Region, once a tag is provided to a guided hunt it cannot be reused, whether or not the hunt was successful (Joint Secretariat 2017).

Other human-induced Polar Bear mortality can include defense of life and property kills and humane kills. The frequency of defense of life and property kills generally increases during the ice-free season when Polar Bears are on land (McDonald et al. 1997; Makivik Corporation 2001; Stirling and Parkinson 2006; Dowsley 2007; Dowsley and Wenzel 2008; Canadian Wildlife Service 2009; Nirlungayuk and Lee 2009; Towns et al. 2009; Henri 2010, 2012; Kotierk 2010; Lemelin et al. 2010; Clark et al. 2012). A number of different factors have the potential to increase the frequency of defense kills. Some of these factors include the increasing length of time Polar Bears spend on land due to longer ice-free seasons, increased Polar Bear-human interaction, bears coming off the sea ice in poor body condition, increasing human activity (e.g. growing communities, camps, tourism, mineral exploration and development, oil and gas industry, research activity) in Polar Bear habitat, and greater amounts of garbage and carcasses to attract bears (Stenhouse et al. 1988; Stirling et al. 1999; Derocher et al. 2004; Dyck 2006; Schliebe et al. 2008). In areas where quotas exist, defense of life and property kills are usually included in the total allowable harvest of that area. When a Polar Bear is sick or injured, the usual practice is for a Conservation Officer to carry out a humane kill. Unlike defense of life and property kills, humane kills are usually not counted in the total allowable harvest for the area where the humane kill occurs (Government of Nunavut 2018). The exception to this is within the ISR, where humane kills are taken out of the total allowable harvest.

From the 2014-2015 season to the 2018-2019 season, the average number of human-caused mortalities (including harvest, defense kills, mortalities due to research), and mortalities due to other human activity (such as a Polar Bear being struck by a

vehicle, or a ship) of Polar Bears within Canadian subpopulations (and subpopulations shared with other countries) was approximately 519.3 annually.

Canada has had a strong adaptive management system in place for Polar Bears for decades (PBAC 2011). This management system is based on conservation principles and Indigenous harvesting rights (PBAC 2011). It is an ongoing and dynamic collaboration between partners involved in Polar Bear management in Canada. Polar Bear harvest systems vary by jurisdiction, and are described in Parts 2 – 7 of this document.

Polar Bears face naturally limiting factors, such as low reproductive rates due to delayed maturity, small litter sizes, 2-3 years of maternal dependency, and high cub mortality (Bunnell and Tait 1981). While the number of Polar Bears harvested in Canada each year is typically well below the Total Allowable Harvest on a national scale, if harvest and other sources of human-induced mortality are not properly managed, these naturally limiting factors may contribute to population declines (COSEWIC 2018).

For more information on Polar Bear harvest management, please refer to the jurisdictional Management Plans and Recovery Strategies in parts 2 – 7 of this Management Plan.

Pollution (IUCN/CMP Threat # 9.1 – Domestic & Urban Waste Water; IUCN/CMP Threat # 9.2 – Industrial & Military Effluents; IUCN/CMP Threat # 9.4 – Garbage & Solid Waste; IUCN/CMP Threat # 9.5 – Air-Borne Pollutants):

Apex predators, including Polar Bears, are often exposed to high levels of organic and inorganic pollutants due to the fact that the pollutants bioaccumulate in the marine food web (AMAP 2017). Polar Bears' reliance on a high-fat diet of marine species increases their indirect exposure to chlorinated, brominated, and fluorinated compounds¹⁵, and heavy metals (AMAP 2017). Most of these pollutants originate in industrialized areas of the world and are naturally transported to arctic marine ecosystems (Bard 1999), though some are currently sequestered in glaciers and permafrost and may be released as atmospheric temperatures rise (Schuster et al. 2018).

Pollution levels, types of pollutants (i.e. organic vs inorganic), and temporal patterns in pollutant levels vary across Polar Bear subpopulations (Norstrom et al. 1998; Dietz et al. 2006; Letcher et al. 2010, 2018). Some research has shown that pollutants affect Polar Bears' sex steroids, thyroid levels, vitamins, growth and development, liver and renal histopathology, reproductive organs, central nervous system toxicity, bone density, immune system function, carcinogenicity, and reproductive performance (e.g., McKinney et al. 2010; Sonne 2010; Sonne et al. 2011; Dietz et al. 2015; Gabrielsen et al. 2015). There is concern that lactating female Polar Bears may transfer pollutants to

¹⁵ Chlorinated, brominated and fluorinated compounds primarily originate from industrial and agricultural activities south of the arctic, and are transported to the arctic by air and ocean currents and river outflows (Routti et al. 2019).

their offspring through their milk (Polischuk et al. 2002; Bytingsvik et al. 2012; Jenssen et al. 2015).

Correlative studies have found relationships between biological processes (e.g., hormone level, bone density) and pollution quantity at the individual level (Sonne 2010). Generally, it is difficult to demonstrate that pollutants cause population level declines (Jenssen et al. 2015). However, one study documented high enough concentrations of PCB, DDT, etc. in archived tissue samples from Svalbard to conclude that toxins likely limited the growth of the Polar Bear population that was expected after a prohibition on Polar Bear hunting was implemented (Derocher et al. 2003).

It has been hypothesized that as sea ice melts, Polar Bears will increasingly seek terrestrial food sources (Gormezano et al. 2013), and in doing so may wander into human settlements where they may come into contact with and ingest plastics. More research is needed on the effects of plastics on Polar Bears (Orihel et al. 2019). Both scientific research and Indigenous Knowledge have identified the presence of plastics in Polar Bear scat (Gormezano et al. 2013; Toth 2019) and in the stomachs of harvested Polar Bears (Iversen et al. 2013; Toth 2019). However, the intention of these studies was not to focus on the quantity of plastics in Polar Bear stomachs or scat. Additional scientific and Indigenous Knowledge research is required to determine whether increased exposure of Polar Bears to plastics will have a population-level impact on the species.

For more information on polar bears and pollution, please refer to the jurisdictional Management Plans and Recovery Strategies in parts 2 – 7 of this Management Plan.

Negligible Threat Categories:

Energy Production and Mining (IUCN/CMP Threat # 3.1 – Oil & Gas Drilling; IUCN/CMP Threat # 3.2 – Mining & Quarrying):

Human activity involving exploration for energy and minerals has been occurring in the arctic since the mid-1960s (COSEWIC 2018). Oil and fuel spills have the potential for mortality and disturbance of Polar Bears (Stirling et al. 1990; Hurst et al. 1991; Durner et al. 2000; Arctic Council 2009). Some studies have shown that Polar Bears may experience an inability to effectively thermoregulate if their fur is oiled. Organ failure and death can occur if Polar Bears ingest oil by grooming or eating contaminated prey (Stirling et al. 1990; Hurst et al. 1991; Durner et al. 2000; Arctic Council 2009). Maternity den disturbance also may occur, and negative impacts to Polar Bear prey (such as seals) have occurred as direct result of oil and fuel spills (COSEWIC 2018). No major spills have occurred to date in areas where Polar Bear inhabit, and this may be partially attributable to the relative inaccessibility of the Northwest Passage in its current state. There is, however, potential for significant ecological consequences if a large spill does occur, as current infrastructure and capacity for handling large spills is limited in the Canadian arctic (COSEWIC 2018). In the event that wildlife is exposed to spills of

hazardous chemicals, such as hydrocarbons, there are no facilities available for decontamination (COSEWIC 2018). The Government of Canada is currently undertaking initiatives to mitigate the negative ecological consequences of potential future oil and fuel spills (Transport Canada 2018a). For example, \$1.5 billion has been invested in Canada's Oceans Protections Plan with the goal of protecting Canada's coasts and waterways. In particular, \$161 million of that \$1.5 billion investment will help achieve greater marine protection for Canada's arctic, through initiatives such as expanding the National Aerial Surveillance Program to detect oil spills in the arctic (Transport Canada 2018b). Additionally, Canada has implemented the International Maritime Organization's (IMO) prohibition on the use and carriage for use as fuel of heavy fuel oil by ships in Canadian Arctic water (Transport Canada 2025).

Large oil and gas reserves occur within the Norwegian Bay, Davis Strait, Baffin Bay, Lancaster Sound, Viscount Melville Sound, and Southern and Northern Beaufort Sea subpopulations (Chen et al. 2004; Gautier et al. 2009). In the past, these reserves were not exploited because of their northern location and the challenging environments in which they occur. However, environmental change is likely to facilitate greater industrial access to oil and gas reserves, leading to an increase in industrial activities in the arctic (Prowse et al. 2009). Increasing exploration, seismic activity and development is occurring in the Davis Strait subpopulation (CNLOPB 2018), though the majority occurs in the Greenland portion of the Davis Strait subpopulation. The Lancaster Sound subpopulation is an exception to this, as a large portion of this subpopulation is covered by the Tallurutiup Imanga National Marine Conservation Area. No oil or gas extraction is permitted within National Marine Conservation Areas (Parks Canada 2018a).

Intense mineral exploration occurs across much of the Canadian arctic within the range of Polar Bears in the Northwest Territories, Nunavut, Québec and Labrador (COSEWIC 2018). Polar Bears can be displaced from terrestrial ice-free season refuge and denning habitat by construction of mines (Amstrup 1993; Linnell et al. 2000; Atatahak and Banci 2001; Dyck and Baydack 2004; Keith 2005; Slavik 2010, 2013), and if year-round shipping occurs in association with mining operations, displacement from marine habitat is also possible (COSEWIC 2018). The construction of mines and associated year-round shipping are both subject to approval via the processes set out in the applicable Land Claims Agreements.

For more information on polar bears and energy production and mining, please refer to the jurisdictional Management Plans and Recovery Strategies in parts 2 – 7 of this Management Plan.

Transportation and Service Corridors (IUCN/CMP Threat # 4.3 – Shipping and Shipping Lanes):

Over the past 10 years, the amount of shipping activity in Canadian arctic waters has increased (Derksen et al. 2019). Disturbance and the potential for shipping accidents associated with increasing levels of shipping activity in the arctic, including community

re-supply, industrial shipping and tourism, present increasing threats to Polar Bears (PBAC 2011).

Construction of new ports and year-round shipping requiring ice-breaking could lead to the displacement of Polar Bears from marine foraging habitat, and may negatively affect Polar Bear prey species (i.e. seal species) (Blix and Lentfer 1992; Slavik 2010, 2013; Canadian Wildlife Service 2009). Ice-breaking in the Northwest Passage would enable arctic shipping routes to open by mid-century and container ship traffic would likely increase as a result (COSEWIC 2018; Smith and Stephenson 2013).

For more information on polar bears and transportation and service corridors, please refer to the jurisdictional Management Plans and Recovery Strategies in parts 2 – 7 of this Management Plan.

Human Intrusions and Disturbance (IUCN/CMP Threat # 6.1 – Recreational Activities; IUCN/CMP Threat # 6.3 – Work & Other activities):

The impacts of tourism on Polar Bears are largely unknown (Prestrud and Stirling 1994; Dyck and Baydack 2004; Lemelin 2006; Andersen and Aars 2008). In one study, managers, tour operators, community members, and scientists who were interviewed expressed a general consensus that <10% of the Polar Bear population in Canada is exposed to most types of recreation, including tourism (Rode et al. 2018), though this is an approximation. Polar Bear viewing tourism occurs in Manitoba, Nunavut, Northwest Territories, Ontario, the Nunavik Marine Region, the Eeyou Marine Region, and Labrador (COSEWIC 2018), though concerns exist that viewing bears in the wild displaces them from terrestrial and sea ice habitats and may cause habituation that will create changes in behaviour leading to more human-bear conflict (Tetlich et al. 2004; Nirlungayuk and Lee 2009). Increased interaction between humans and Polar Bear is already occurring in northern communities (Government of Nunavut 2018). Further human-bear conflicts may arise in the future as anthropogenic activities, such as tourism, increase. Human-bear conflicts have resulted in the destruction of property, danger to humans, danger to bears due to human-caused harassment, and bear mortality in defense of life or property (Government of Nunavut, 2018).

As cruise ship traffic and interest in visiting Polar Bear dens (particularly in the Churchill, Manitoba area) increases, there is a growing need for more research on the impact(s) of human intrusions and disturbance on Polar Bears.

For more information on polar bears and human intrusions and disturbance, please refer to the jurisdictional Management Plans and Recovery Strategies in parts 2 – 7 of this Management Plan.

Unknown Threat Categories:

Invasive and Other Problematic Species and Genes (IUCN/CMP Threat # 8.1 – Invasive Non-Native/Alien Species/Diseases):

As warming temperatures shifts the distribution of some species, novel pathogens (i.e. pathogens that do not traditionally occur in a given area) may enter the arctic ecosystem (Burek et al. 2008; Kutz et al. 2013), where Polar Bears may come into contact with them. Recent research suggests that several pathogens are already increasing in prevalence at the southern limit of the Polar Bears range (Pilfold et al. 2021). Further, existing pathogens, which have not caused substantial challenges for Polar Bears in the past, could become a significant mortality factor for Polar Bears, or they may reduce productivity on individual bears that are physiologically stressed (Patyk et al. 2015). This threat should be further investigated, as its impact on Polar Bears is unknown, though some research suggests that Polar Bears may have a relatively low immunity to pathogens because they have evolved in a harsh environment that limits parasite richness (Weber et al. 2013).

An increase in some native species, such as Brown Bears, onto sea ice habitat due to climate change may threaten Polar Bears due to increased interspecific conflict between the species (Joint Secretariat 2015; Miller et al. 2015).

For more information on polar bears and invasive and other problematic species and genes, please refer to the jurisdictional Management Plans and Recovery Strategies in parts 2 – 7 of this Management Plan.

Natural System Modifications (IUCN/CMP Threat # 7.3 – Other Ecosystem Modifications):

While there are many unknowns regarding the impacts of natural system modifications on Polar Bears, concerns exist regarding potential biotic and abiotic ecosystem changes. Some examples of potential biotic changes include alterations in Polar Bears' prey dynamics and prey capture rates due to sea ice changes (Derocher et al. 2004), population-level impacts on seals resulting from commercial fisheries (DeMaster et al. 2001), or indirectly through decreased availability of Ringed seals as prey (Bradley et al. 2005; Cattet et al. 2004), a potential increase in seal predation by Orcas (COSEWIC 2018), and an increase in Bowhead Whale carcass availability to Polar Bears as a result of increasing Bowhead Whale predation by Orcas (Galicia et al. 2016).

Two examples of potential abiotic changes include ecosystem changes resulting from altered fresh water inputs from Hudson Bay dams (Barber 2015), and altered water flows (impacts of water diversion) affecting freeze-up in Southern Hudson Bay (COSEWIC 2018). Some concern also exists in regards to the threat of future hydro development projects in Labrador (COSEWIC 2018). Hydro dams can release freshwater onto sea ice, and this may lead to various changes in sea ice dynamics with

potential negative implications for Polar Bears (Laforest et al. 2018; NMRWB 2018). The threat to Polar Bears is not the construction of the dams, but the impact that freshwater outputs from the dams can have on sea ice.

More research is needed to clarify the severity of Natural System Modifications as a threat to Polar Bears.

For more information on polar bears and natural system modifications, please refer to the jurisdictional Management Plans and Recovery Strategies in parts 2 – 7 of this Management Plan.

5. Management Objective

The management objective for Polar Bear is to maintain the resilience, redundancy and representation of the population in the species' known range in Canada.

In line with adaptive management practices, and in consideration of the uncertainty of the impacts of climate change on Polar Bear, a re-evaluation of the management objective is recommended to occur in ten years (2035). This objective pertains to the single Polar Bear Designatable Unit in Canada, as defined by COSEWIC. The management objective recognizes the ecological and cultural importance of the Polar Bear in Canada. Achieving this management objective will help ensure that the species meets its life history¹⁶ requirements and will help provide sustainable harvest opportunities to current and future generations of Indigenous rights holders.

Resilience, as used in the above management objective, is the ability of a species to recover after a perturbation. In order to ensure the resilience of the Canadian Polar Bear population, sufficient genetic diversity, health, and subpopulation abundance above minimum viability thresholds must be maintained such that the Canadian Polar Bear population is resilient enough to be able to withstand catastrophic events (e.g. new diseases, natural disasters, etc.), rebound from disturbance, and sustain continued Indigenous rights holders' harvest opportunities. If the Canadian Polar Bear population maintains resilience, it will be more capable of rebounding from disturbance or perturbations (such as over harvest, oil spills, a disease outbreak, etc.). The resilience of the Canadian Polar Bear population is recommended to be re-evaluated, along with the management objective, in ten years (2035).

Redundance, as used in the above management objective, is the presence of multiple and widespread subpopulations of a species that enables the species' long-term persistence in the face of ecological and environmental change occurring in specific locations. On the national and international scale, the Canadian Polar Bear population is managed as a single Designatable Unit. On the jurisdictional scale, Polar Bear is managed on the basis of the 14 subpopulations that occur across seven provinces and

¹⁶ A species' life history is its pattern of survival and reproduction, along with the traits that directly affect survival and the timing or amount of reproduction (Fox and Messina 2013).

territories in Canada. The more subpopulations persist, the more likely it is that the species will persist over the long term. The redundancy of the Canadian Polar Bear population is recommended to be re-evaluated, along with the management objective, in ten years (2035).

Representation, as used in the above management objective, refers to the occurrence of Polar Bear in a range of ecosystem types (refer to section 3 for more information about ecosystem and habitat types used by Polar Bears), the extent of genetic diversity that the species possesses, and the species' overall ability to withstand environmental change. Maintaining Polar Bears across their present range in these habitats is a vital component of ensuring sufficient representation. There are some unknowns regarding how sea ice conditions will change across the Canadian Arctic, and the capacity of Polar Bears to adapt over time; see section 4.2 Description of Threats (Climate Change and Severe Weather (IUCN/CMP Threat # 11.1 – Habitat Shifting and Alteration) for additional information. The representation of the Canadian Polar Bear population is recommended to be re-evaluated, along with the management objective, in ten years (2035).

Polar Bear management objectives for each of the 14 subpopulations, which have been identified by the relevant jurisdictional authorities, are described in Parts 2-7 of this document.

6. Broad Strategies and Conservation Measures

6.1 Actions Already Completed or Currently Underway

Conservation and Management of the Polar Bear and its habitat in Canada:

In 2011, Environment and Climate Change Canada worked closely with the PBAC to publish the National Polar Bear Conservation Strategy for Canada. This strategy was developed by the PBAC and its purpose was to guide Polar Bear co-management activities by partners across Canada, including federal, provincial and territorial governments, Wildlife Management Boards/Advisory Councils, and Indigenous organizations. It contains over-arching objectives aimed at promoting coordination and providing guidance for Polar Bear management and conservation of actions across jurisdictions, and with co-management partners within Canada. There are also a series of annexes that provide an overview of how Canada's Polar Bear co-management partners manage key conservation threats and challenges. The strategy was completed before the Polar Bear was listed as a species of special concern under SARA, and was not intended to fulfill the legislative requirement for a Management Plan.

The PBAC provides a forum for provincial, territorial and federal governments, as well as Indigenous organizations and Wildlife Management Boards/Advisory Councils, to work together to manage Polar Bears in Canada (Lunn et al. 2002), and to ensure that Canada fulfills its obligations to the *Agreement on the Conservation of Polar Bears*

(1973). In particular, the PBAC provides input, advice and recommendations to the relevant management authorities regarding research, monitoring, and management requirements and initiatives, to help ensure the conservation and management of Polar Bears in Canada, as well as to help facilitate cooperation and coordination between jurisdictions in Canada. The Polar Bear Technical Committee (PBTC) provides a forum for technical experts to share and discuss information and advice among themselves. That information and advice is then reported back to the PBAC. In particular, the PBTC supports the PBAC by reviewing scientific research and Indigenous Knowledge and providing an annual status assessment of the 14 Polar Bear subpopulations in Canada. The status assessment is updated when new information about one or more subpopulations becomes available. The PBTC includes representatives from each jurisdiction in Canada where Polar Bears are found, as well as representatives from Wildlife Management Boards or Advisory Councils and Land Claim organizations. The information provided in the PBTC's annual status assessment table helps facilitate the adaptive management of Polar Bear in Canada by providing management authorities with the latest information related to the status of Canada's Polar Bear subpopulations.

Climate change is the largest threat facing Polar Bears (COSEWIC 2018). As a signatory to the Paris Agreement, Canada is working with partners around the world to limit climate change, biodiversity loss and pollution through many channels, including agreements such as the United Nations Framework Convention on Climate Change (UNFCCC) and the United Nations Convention on Biological Diversity (CBD), as well as activity through international engagement such as the United Nations Environment Programme, the Global Environment Facility, the G7 and the G20 and regional cooperation (ECCC 2024).

Total Allowable Harvest levels are in place throughout Nunavut, the Inuvialuit Settlement Region (Yukon and Northwest Territories) and Nunatsiavut (Newfoundland and Labrador). In the aforementioned areas, Canada has concluded modern treaty agreements, and removal levels are determined or recommended by Wildlife Management Boards or Advisory Councils. Wildlife Management Board and Advisory Council decisions and recommendations are generally given effect by provincial and territorial government authorities, who accept, reject or vary the decisions/recommendations, and implement them using provincial and territorial legislation. Within the Nunavik Marine Region and an overlap area between the Nunavik Marine Region and Eeyou Marine Region (offshore from Québec), a harvest quota has been established by the Government of Canada and the Government of Nunavut for the Southern Hudson Bay subpopulation. The management of Polar Bears harvested onshore in Ontario, Manitoba and Québec falls under provincial jurisdiction. Harvest management systems within Canada's subnational jurisdictions are further described in Parts 2 – 7 of this Management Plan, where applicable.

In 1991, Crown-Indigenous Relations and Northern Affairs Canada (CIRNAC; formerly Indian and Northern Affairs Canada) established the Northern Contaminants Program (NCP) in response to concerns about human exposure to elevated levels of contaminants in wildlife species (such as the Polar Bear) that are important to the

traditional diets of northern Indigenous peoples (Government of Canada 2019). The NCP, in collaboration with regional health authorities, regularly reports information about contaminants so consumers of traditional/country foods can make informed decisions (Government of Canada 2019).

The Impact Assessment Agency of Canada (IAAC; formerly the Canadian Environmental Assessment Agency) is the federal agency responsible for administering the *Impact Assessment Act* (IAA; and the former *Canadian Environmental Assessment Act, 2012*). The IAA requires that major projects undergo an impact assessment to identify positive and negative impacts. Information gathered during the impact assessment is used to identify significant adverse effects and ways to mitigate them before projects are built (IAA 2025). The impact assessment process in Canada's northern territories is based on a unique co-management approach, rooted in the legal and cultural frameworks of land claims agreements with Indigenous Peoples. Each territory has its own regulatory regime, defined in legislation specific to the region: Yukon: [Yukon Environmental and Socio-economic Assessment Act](#) (YESAA); Northwest Territories: [Mackenzie Valley Resource Management Act](#) (MVRMA); and Nunavut: [Nunavut Planning and Project Assessment Act](#) (NuPPAA). Additionally, in the [Inuvialuit Settlement Region](#) (in the Northwest Territories), the regulatory regimes defined in both the [Inuvialuit Final Agreement](#) (IFA) and the [Impact Assessment Act](#) (IAA) apply (other than in the Yukon North Slope, where YESAA can apply instead of the IAA) (CIRNAC 2025). The *Species at Risk Act* outlines obligations related to Project Reviews (s. 79). This section ensures that the authority responsible for conducting a federal assessment of the environmental effects of a project identifies the adverse effect on listed wildlife species and its critical habitat. This includes Polar Bears. If the project is carried out, the authority must ensure that measures are taken to avoid or lessen those adverse effects and to monitor them. The measures must be taken in a way that is consistent with any applicable recovery documents. However, this obligation does not apply to projects reviewed pursuant to the *Nunavut Project and Planning Assessment Act*.

Transport Canada is the federal agency responsible for domestically implementing the international standards set by the International Maritime Organization (IMO) (Transport Canada 2017). For example, the *Polar Code* (an international code for the safety of and prevention of pollution from ships operating in polar waters, adopted in 2015) introduced requirements for arctic Shipping at the international level. Amongst other things, the *Polar Code* helps protect the marine environment by addressing the risks unique to polar waters not covered by other IMO instruments (International Maritime Organization, n.d.). For example, the *Polar Code* prohibits oil, noxious substances, and (with some exceptions) sewage and garbage, all of which can have a negative impact on Polar Bears and other species which are dependent upon marine environments, from being discharged into the sea (International Maritime Organization, n.d.). As well, the *Polar Code* requires that vessels that operate in polar waters have double hull construction to help prevent oil spills in case of an accident (International Maritime Organization, n.d.). The *Oceans Protection Plan* is another initiative that has been undertaken by Transport Canada to protect Polar Bear habitat. More information on the *Oceans Protection Plan*

can be found in section 4.2 (Negligible Threat Categories: Energy Production and Mining) of this document.

In 2004, the Government of Canada, working closely with provincial and territorial partners, produced 'An Invasive Alien Species Strategy for Canada'. The strategy seeks to reduce the frequency and impact of harmful species introductions through the development of early warning systems and response plans that specify eradication, containment and control procedures (ECCC 2004). In addition, in June 2018, federal, provincial and territorial governments finalized a 'Pan-Canadian Approach to Wildlife Health'. The approach seeks to coordinate wildlife health surveillance and management programs across portfolios and levels of government, and work with key non-government partners, experts, and Indigenous rights holders, to move Canada from a reactive disease-by-disease approach to addressing wildlife health threats to a proactive regime (ECCC 2018b). In a changing arctic landscape, species from traditionally more southern ecosystems may move into the Arctic, which could introduce novel pathogens and/or diseases for polar bears (Polar Bear Range States 2015).

In Canada, the management of hydro development projects falls under the jurisdiction of the provinces and territories, and authorities from these jurisdictions may be contacted to obtain more information related to specific projects. However, the construction of a hydro dam is likely to be captured by federal legislation, namely the *Canadian Environmental Assessment Act*, CEAA) (Government of Ontario 2017). The CEAA requires that proponents of proposed hydro development projects undertake an environmental assessment to determine what negative environmental impacts, if any, may occur once the proposed project is completed and operational (Government of Ontario 2017).

The Government of Canada establishes and maintains protected areas including habitat important to Polar Bears, such as National Parks, National Marine Conservation Areas, National Wildlife Areas, Marine National Wildlife Areas, Migratory Bird Sanctuaries and Marine Protected Areas, and Other Effective Area-Based Conservation Measures (ECCC 2020; ECCC 2023). Figure 2 depicts federal and non-federal protected areas within the Canadian Polar Bear distribution range. In National Parks such as Sirmilik National Park and Ukkusiksalik National Park, Parks Canada has taken measures to effectively manage access to Polar Bear dens during key periods by establishing zoning measures (Parks Canada 2018b). Marine Protected Areas in Canada are protected from mining, oil and gas extraction, dumping, and trawling (Jessen et al. n.d.).

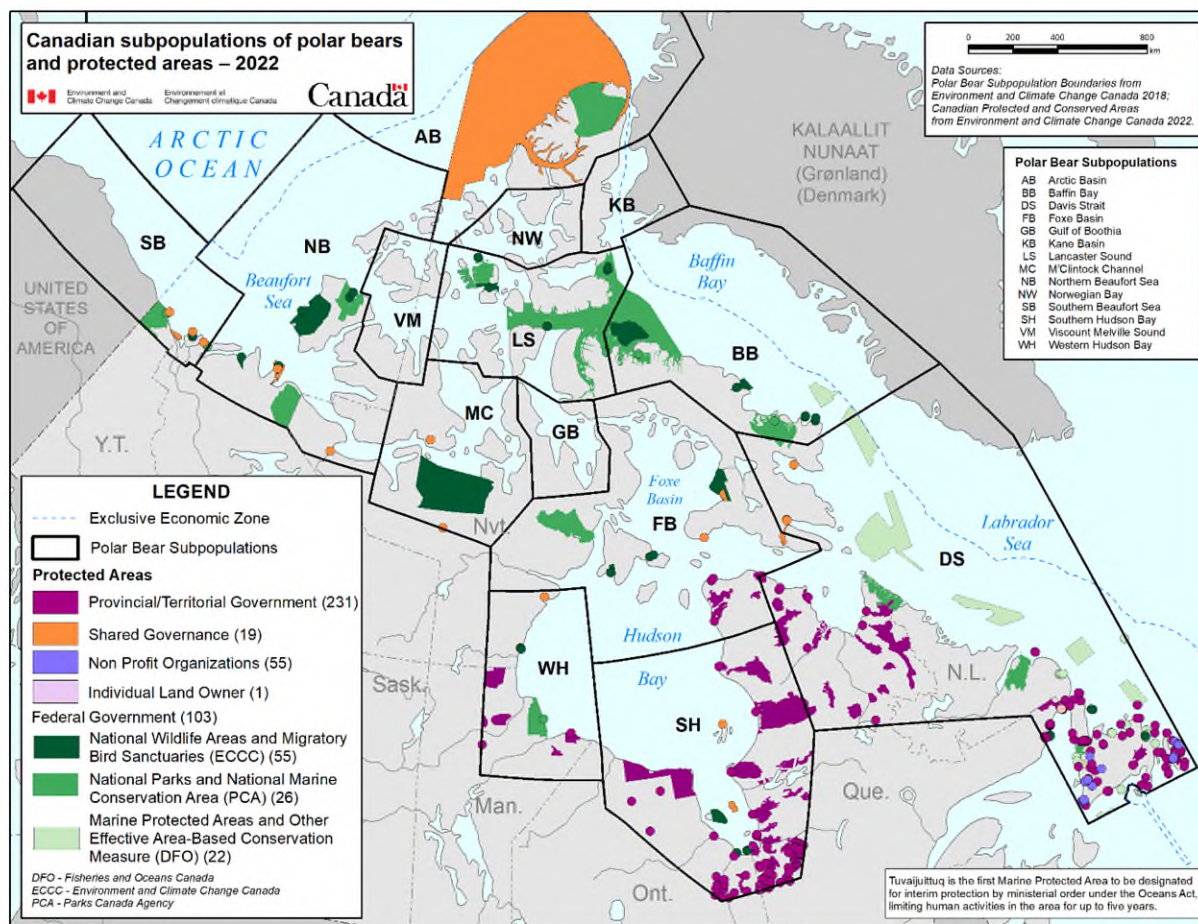


Figure 2: Protected areas within Canadian Polar Bear subpopulations (source: ECCC 2023). The dotted line surrounding Canada represents the exclusive economic zone.

International Cooperation

As a signatory to the *Agreement on the Conservation of Polar Bears* (1973), Canada works with other Range States (Greenland, Norway, Russia, and the United States) to protect Polar Bears and their habitats. In 2015, the Range States produced the Circumpolar Action Plan, which is a Conservation Strategy for the Polar Bear throughout the circumpolar arctic. The Circumpolar Action Plan states that the Range States will identify best practices to ensure the long-term persistence of Polar Bear by taking action to mitigate threats such as climate change, while continuing to provide sustainable harvest opportunities for Indigenous rights' holders (Polar Bear Range States 2015). In particular, the Range States (including Canada) will share, develop and implement Best Management Practices (BMPs) to help address threats to Polar Bears from natural resource development, contaminants, tourism, shipping and interactions with humans (Polar Bear Range States 2015).

In the case of Polar Bear subpopulations that are shared between Canada and international co-management partners, international agreements such as Memoranda of

Understanding (MoUs) or user-to-user arrangements have been developed in accordance with Land Claim Agreements and respective of jurisdictional protocols or interjurisdictional agreements. Such agreements act as mechanisms to reach concurrence on management objectives, Total Allowable Harvest, and shared harvest allocation. Existing agreements include the Inuvialuit-Inupiat Agreement for the shared Southern Beaufort Sea subpopulation – originally signed in 1988; the MoU between Canada and the United States for the shared Southern Beaufort Sea subpopulation – 2008; and the MoU between Greenland, Nunavut and Canada for the shared Kane Basin and Baffin Bay subpopulations – 2009.

Canada is a signatory to the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) (Government of Canada 2018). CITES aims to ensure that international trade of listed species does not threaten their survival. Under CITES, Polar Bears have been listed on Appendix II since the inception of the convention in 1975 and international trade of the species is tracked. A permit for export of Polar Bear from Canada is only issued if the Polar Bear (including any Polar Bear part) has been legally obtained and only if advice from the CITES Scientific Authority in Canada indicates that the trade will not be detrimental to the survival of the species. This advice is termed a non-detriment finding or NDF (Government of Canada 2017a). Considerations for making the non-detriment finding include the biology, conservation status, trade levels and harvest management of the species, and this information is publicly available on the [Government of Canada website](https://www.canada.ca/en/environment-climate-change/services/convention-international-trade-endangered-species/non-detriment-findings/polar-bear.html)¹⁷. In Canada, CITES is implemented through the Wild Animal and Plant Protection and Regulation of International and Interprovincial Trade Act (WAPPRITA) by Environment and Climate Change Canada (Government of Canada 2017b).

The Stockholm Convention on Persistent Organic Pollutants (POPs) was signed and ratified by Canada in 2001 (ECCC 2017). Its goal is to reduce levels of POPs entering the environment over time; as a result of eliminating or restricting releases of POP industrial chemicals and pesticides, unintentionally produced POP by-products and stockpiles and wastes of POPs (ECCC 2017). Canada occasionally makes documented submissions to suggest the regulation of emerging and/or priority POPs through their addition to Annex A, B or C of the Stockholm Convention (R. Letcher, pers. comm.).

In Canada, legislation regulating tourism falls under the jurisdictions of the provinces and territories. However, the Circumpolar Action Plan calls for the Range States to “collect occurrence data, and develop BMPs, with the goal of balancing needs of tourism-related activities and their impact on Polar Bears” (Polar Bear Range States 2015: page 59).

¹⁷ www.canada.ca/en/environment-climate-change/services/convention-international-trade-endangered-species/non-detriment-findings/polar-bear.html

Scientific and Indigenous Knowledge Monitoring and Research

Collaboration on research and monitoring initiatives between the federal Government and partners is essential for the conservation and management of Polar Bears in Canada. The partners (including Wildlife Management Boards, Advisory Councils, and federal, provincial and territorial governments) involved in Polar Bear management in each Canadian subpopulation are listed in Table 3 in section 3.2 of this document. Environment and Climate Change Canada works closely with partners to determine research priorities which will help inform effective Polar Bear conservation and management in Canada (Government of Canada 2009). Canada's partners each have one or more specific focuses, such as ensuring sustainable harvest levels, harvest monitoring, and furthering understanding of Polar Bear demography, ecology, status, and health.

Federal research forms part of Canada's broad commitments under the international *Agreement on the Conservation of Polar Bears* (1973). To meet commitments made under and/or obligations stemming from the *Convention on Biological Diversity* (1992), CITES, and Canada's *Species at Risk Act* (2002), both scientific and Indigenous Knowledge are given thorough consideration when decisions are made relating to the long-term conservation of Polar Bears, including protection from overexploitation from international trade. Federal research has focused on broad ecological questions applicable to Polar Bears across the circumpolar arctic. Targeted research enhances scientific knowledge and mobilizes Indigenous Knowledge of population dynamics, Polar Bear health, and threat assessments, and furthers understanding of barriers to potential recovery while aiding in the development and implementation of effective conservation actions. This information is then used by jurisdictions and committees (such as COSEWIC and the PBTC) who regularly assess the status of Polar Bears in Canada.

Environment and Climate Change Canada's research focus has included: furthering understanding of Polar Bear ecology, Arctic marine ecosystems, and the effects of chemical pollutants on Polar Bear health; contributing to assessments of Polar Bear subpopulation abundance and trend; examining relationships between Polar Bears, prey, and sea ice; and understanding the relationship among Indigenous Peoples and Polar Bears. Currently, Environment and Climate Change Canada has five primary scientific and Indigenous Knowledge research priorities, as outlined in Table 5, below. The Department recognizes the importance of both scientific and Indigenous Knowledge in Polar Bear research and monitoring and is committed to inclusion and partnerships with Indigenous organizations and communities. Each of the five research priorities includes ongoing engagement and knowledge exchange with northern communities, Indigenous organizations, and co-management partners. Jurisdictional research priorities are further expanded in Sections 2-7 of the Management Plan.

1300 **Table 5.** Environment and Climate Change Canada's research priorities for Polar Bear

Research Priority	Description	Examples of Ongoing Research
Habitat and climate change	Understanding links among changes in climate, sea ice habitat, Polar Bear behaviour, body condition and population status	▪ Long-term research to evaluate the impacts of climate change on ecology, population dynamics, and status of Polar Bears ▪ Research linking Polar Bear and Ringed seal population dynamics ▪ Ecology and movement of Polar Bears ▪ Long-term monitoring of trends in declining sea ice habitat
Population assessment	Development of potential new field and statistical methodologies to assess Polar Bear population demography	▪ Development of integrated population models incorporating harvest information, individual movements and Indigenous Knowledge ▪ Collaboration on population assessments using non-invasive research techniques ▪ Co-production of scientific and Indigenous Knowledge to assess Polar Bear health and status
Genetics and health and pollutants	Research into population genetics, chemical contaminants and Polar Bear health	▪ Measuring Polar Bear health through epigenetic aging ▪ Information related to Polar Bear health and body condition, such as the presence of plastics, is gathered from harvesters and Indigenous Knowledge holders ▪ Studies of disease prevalence in Polar Bears ▪ Assessing body condition using biological metrics ▪ Research, monitoring and surveillance of exposure to human-made chemical pollutants including heavy metals in Polar Bear fat, liver and/or muscle tissues and related impacts and effects. ▪ Assessment of population genetic structure, unique genetic variation and adaptive potential ▪ Developing cell lines to assess impacts of contaminants and disease exposure in polar bears

Research Priority	Description	Examples of Ongoing Research
Foraging ecology and ecosystem dynamics	Polar Bear foraging ecology in relation to prey dynamics in marine and terrestrial environments	- Using new technologies to study the impact of Polar Bear predation of ancillary prey species - Understanding prey dynamics, ecosystem function and energetics
Indigenous Knowledge and local perspectives of Polar Bears, seals, Arctic marine ecosystems and human-polar bear relationships	Engagement with Indigenous partners in Polar Bear research and monitoring	- Documenting Indigenous Knowledge about Polar Bear abundance, distribution, health and habitat - Understanding pathways to human-Polar Bear coexistence in a changing Arctic - Exploring approaches to Indigenous Knowledge mobilization in polar bear management decision-making - Ongoing engagement and knowledge exchange with northern communities, Indigenous organizations, and co-management partners

Many of the ongoing research initiatives listed above are done in collaboration with regional jurisdictions and international partners.

Table 5 (above) focuses on Environment and Climate Change Canada's scientific and Indigenous Knowledge research and monitoring priorities. Specific information pertaining to scientific and Indigenous Knowledge monitoring and research initiatives related to Polar Bears at the regional level can be found in Parts 2 – 7 of this Management Plan.

Public Outreach and Education

Environment and Climate Change Canada maintains a webpage for members of the public to learn about the initiatives which are being undertaken by the Government of Canada to manage and conserve Polar Bears in Canada. In particular, this webpage addresses Polar Bears and CITES, the specific management and conservation actions being taken by the Government of Canada at the national and international level, actions being taken to address the impacts of climate change, and scientific and Indigenous Knowledge research initiatives related to Polar Bears. The webpage can be accessed [here](http://www.canada.ca/en/services/environment/wildlife-plants-species/wildlife-habitat-conservation/conservation-polar-bears.html)¹⁸.

¹⁸ www.canada.ca/en/services/environment/wildlife-plants-species/wildlife-habitat-conservation/conservation-polar-bears.html

Environment and Climate Change Canada works closely with the Government of Nunavut to maintain the [PBAC website](#)¹⁹. The purpose of this website is to share information pertaining to: PBAC and PBTC; Polar Bear biology; Canada's Polar Bear subpopulations; the cultural significance and economic importance of Polar Bears to Indigenous peoples; provincial, territorial, federal, and international legislation related to Polar Bears; national and international Polar Bear management and harvest initiatives; and scientific and Indigenous Knowledge research initiatives related to Polar Bears. This website provides contact information for members of the public to contact the Environment and Climate Change Canada PBAC Secretariat for further information.

The [National Polar Bear Conservation Strategy for Canada](#)²⁰ (hereafter, 'the Strategy') was collaboratively developed and published by the PBAC in 2011. As an active member of the PBAC, Environment and Climate Change Canada played a key role in the finalization of the Strategy. The Strategy is available to members of the public and it provides information pertaining to the roles and responsibilities of all Polar Bear co-management partners in Canada, and it discusses the key threats that Polar Bears face in Canada. Annex I of the Strategy discusses the monitoring of Polar Bears and their habitat, and contains guidelines to help ensure coordinated timelines, and monitoring and sampling protocols for baseline monitoring that use both scientific and traditional user knowledge. Annex II of the Strategy discusses harvest management, and contains guidelines aimed at improving the overall coordination of harvest management in Canada. The main principles of those guidelines are embedded within the broad strategies and management actions discussed in this document.

Through funding programs such as the Aboriginal Fund for Species at Risk (AFSAR), Environment and Climate Change Canada has supported projects aimed at increasing knowledge about Polar Bears and their habitat, as well as addressing human and Polar Bear safety in areas where conflicts may occur. Activities implemented under such projects include Indigenous communities hosting bear safety workshops to provide training on how to mitigate human-Polar Bear conflicts.

Several Canadian jurisdictions have public outreach and education initiatives in place which provide information related to Polar Bear. For more information pertaining to these initiatives, please refer to Parts 2 – 7 of this Management Plan.

Information pertaining to broad strategies, including actions that are completed or currently underway, for Polar Bear conservation and management at the regional level can be found in the jurisdictional recovery strategies and management plans (Parts 2 – 7 of this Management Plan).

¹⁹ www.polarbearsCanada.ca/

²⁰ www.polarbearagreement.org/resources/individual-range-state-action-plans/canada/national-polar-bear-conservation-strategy-english

6.2 Broad Strategies

The primary threat to Polar Bears is habitat loss resulting from climate change (Tynan and DeMaster 1997; Derocher et al. 2004; Laidre et al. 2008; Kovacs et al. 2010; IPCC 2013). While other factors have been assessed by COSEWIC as low or negligible threats, cumulative impacts and interacting relationships between threats may be a potential concern, though knowledge surrounding the impacts of cumulative effects is generally lacking (Vongraven and Richardson 2011). Managing these threats will require the commitment of various levels of government, Indigenous partners, stakeholders, conservation organizations and the public, and cannot be achieved by Environment and Climate Change Canada alone. To achieve the management objective, the following federal broad strategies are recommended and are intended to serve as guidance to the jurisdictions and authorities responsible for the management of Polar Bear in Canada:

- Work closely with Indigenous partners, governments, and stakeholders to co-manage and conserve the Polar Bear and its habitat in Canada
- Support international cooperation for management of the Polar Bear and its habitat throughout the entirety of its range
- Conduct scientific and Indigenous Knowledge research and monitoring initiatives in Canada and support international initiatives to address knowledge gaps regarding Polar Bears
- Promote and support public outreach and education on matters related to Polar Bear management and conservation in Canada

Information pertaining to broad strategies for Polar Bear conservation and management at the regional level can be found in the jurisdictional recovery strategies and management plans (Parts 2 – 7 of this Management Plan).

6.3 Conservation Measures

The following table outlines conservation measures and an implementation schedule that, if undertaken, would support achieving the overall management objective. Conservation measures are organized by the four broad strategies: co-manage and conserve Polar Bears in Canada; support international cooperation; scientific and Indigenous Knowledge research and monitoring; and public outreach and education. Specific information pertaining to conservation measures related to Polar Bears at the regional level can be found in the jurisdictional Management Plans and Recovery Strategies (Parts 2 – 7 of this Management Plan). This section focuses on matters under federal jurisdiction.

1403 **Table 6.** Conservation Measures and Implementation Schedule

Broad Strategy	Conservation Measure	Priority^e	Threats or Concerns Addressed	Timeline
Co-manage and conserve Polar Bears in Canada	1.1 Work closely with domestic partners through such forums as the Polar Bear Administrative Committee (PBAC) and the Polar Bear Technical Committee (PBTC) to support the development and communication of policy, programs and guidelines that manage threats and conserve and enhance Polar Bears and their habitat, particularly in areas subject to habitat loss due to climate change	High	All threats	Ongoing
Co-manage and conserve Polar Bears in Canada	1.2 Review new and updated science and Indigenous Knowledge information on a regular basis to inform management and conservation decisions and actions	High	All threats	Ongoing
Co-manage and conserve Polar Bears in Canada	1.3 Support jurisdictions and co-management partners in working with Indigenous and local northern communities to reduce and monitor Polar Bear-human conflict. Conservation actions will be informed by Land Claims Agreements (where applicable) and may include local and regional initiatives (e.g., managing human-bear conflict, Guardian and monitoring programs, gathering Indigenous Knowledge) up to the national scale (e.g., participation in national conservation and species assessment initiatives).	High	Human intrusions and disturbance (IUCN/CMP Threat #6)	Ongoing

Broad Strategy	Conservation Measure	Priority ^e	Threats or Concerns Addressed	Timeline
Co-manage and conserve Polar Bears in Canada	1.4 Support jurisdictions and co-management partners in working with Indigenous and local northern communities to ensure a sustainable harvest of Polar Bear that follows conservation principles. Conservation actions will be informed by Land Claims Agreements (where applicable) and may include local and regional initiatives (e.g., harvest management, Guardian and monitoring programs, gathering Indigenous Knowledge) up to the national scale (e.g., participation in national conservation and species assessment initiatives).	High	Biological resource use (IUCN/CMP Threat #5)	Ongoing
Co-manage and conserve Polar Bears in Canada	1.5 Work with Indigenous, governmental, and industry partners to minimize the negative effects of human activities on Polar Bears and Polar Bear habitat	Medium	All threats	Ongoing
Co-manage and conserve Polar Bears in Canada	1.6 Promote public engagement in matters related to public safety by encouraging participation in provincial/territorial government wildlife deterrence programs to reduce the risk to human life by Polar Bears, reduce destruction of property by wildlife, and reduce and monitor the number of Polar Bears killed in defence of life and property	High	Biological resource use (IUCN/CMP Threat #5) Human intrusions and disturbance (IUCN/CMP Threat #6)	Ongoing

Broad Strategy	Conservation Measure	Priority ^e	Threats or Concerns Addressed	Timeline
Co-manage and conserve Polar Bears in Canada	1.7 Ensure that jurisdictional management framework (including co-management regimes, federal, provincial and territorial legislation, land claim agreements, and inter-jurisdictional agreement(s) are followed	High	All threats	Ongoing
Support international cooperation	2.1 Support and participate in international Polar Bear conservation, research and monitoring initiatives (e.g. the implementation of the <i>Agreement on the Conservation of Polar Bears</i> (1973), Circumpolar Action Plan (2015 – 2025), etc.) with the goal of managing and conserving Polar Bear and its habitat throughout the species' range	High-Medium	All threats	Ongoing
Support international cooperation	2.2 Continue to regulate international trade of Polar Bears and Polar Bear products, in accordance with obligations as a signatory party to CITES	High-Medium	Biological resource use (IUCN/CMP Threat #5)	Ongoing
Scientific and Indigenous Knowledge, research and monitoring	3.1 Support scientific and Indigenous Knowledge research, and community-based monitoring projects that improve our understanding of Polar Bear distribution, abundance, and subpopulation trends within Canada to allow for targeted conservation efforts	High-Medium	All threats	Ongoing
Scientific and Indigenous Knowledge, research and monitoring	3.2 Monitor the presence and investigate the impacts of contaminants and plastics on Polar Bears	Medium-Low	Pollution (IUCN/CMP Threat #9) Energy production and mining	Ongoing

Broad Strategy	Conservation Measure	Priority ^e	Threats or Concerns Addressed	Timeline
			(IUCN/CMP Threat #3)	
Scientific and Indigenous Knowledge, research and monitoring	3.3 Use scientific and Indigenous knowledge to understand links between changes in climate, sea ice habitat, Polar Bear behaviour, body condition and population status	High	Climate change and severe weather (IUCN/CMP Threat #11)	Ongoing
Scientific and Indigenous Knowledge, research and monitoring	3.4 Conduct research into population genetics and Polar Bear health	Medium	All threats	Ongoing
Scientific and Indigenous Knowledge, research and monitoring	3.5 Conduct research focusing on Polar Bear foraging ecology in relation to prey dynamics in marine and terrestrial environments	Medium	Climate change and severe weather (IUCN/CMP Threat #11)	Ongoing
Public outreach and education	4.1 Promote the sharing of science and Indigenous Knowledge (including the importance of Polar Bears to Indigenous peoples, and the impacts of climate change on Polar Bears) with the Canadian public, international audiences, and decision makers	High	All threats	Ongoing
Public outreach and education	4.2 Support and extend current conservation efforts in protected areas in Canada through the promotion of Polar Bear conservation and stewardship programs	Medium	All threats	Ongoing

Broad Strategy	Conservation Measure	Priority ^e	Threats or Concerns Addressed	Timeline
Public outreach and education	4.3 Support the development and implementation of education, outreach and public engagement activities related to Polar Bear conservation and stewardship	Medium	All threats	Ongoing

^e "Priority" reflects the degree to which the measure contributes directly to the conservation of the species or is an essential precursor to a measure that contributes to the conservation of the species. High priority measures are considered those most likely to have an immediate and/or direct influence on attaining the management objective for the species. Medium priority measures may have a less immediate or less direct influence on reaching the management objective, but are still important for the management of the population. Low priority conservation measures will likely have an indirect or gradual influence on reaching the management objective, but are considered important contributions to the knowledge base and/or public involvement and acceptance of the species.

7. Measuring Progress

Every five years, decisions on implementation under the management plan and progress towards achieving the management plan objective will be measured against the following performance indicators:

- Resilience has been maintained in the Canadian Polar Bear population: The health and genetic diversity of the Canadian population, and subpopulation abundance above minimum viability thresholds, has been maintained such that the Canadian Polar Bear population has enough resilience to be able to withstand catastrophic events, rebound from disturbance, and persist over the long term; thereby ensuring the species' resilience in Canada. This resilience has helped to ensure that harvesting by Indigenous rights holders has remained sustainable.
- Redundance has been maintained in the Canadian Polar Bear population: The 14 widespread Polar Bear subpopulations have continued to persist over the long-term across the Canadian jurisdictions where Polar Bears currently occur, despite ecological and environmental change; thereby ensuring the species' redundance in Canada
- Representation has been maintained in the Canadian Polar Bear population: Polar Bears continue to occur in a range of ecosystem types, have maintained their current level of genetic diversity, and have maintained the ability to withstand environmental change; thereby ensuring the species' representation in Canada

8. References

- AMAP. 2017. Chemicals of emerging Arctic concern. Arctic Monitoring and Assessment Programme, Oslo, Norway.
- Amstrup, S.C. 1993. Human disturbances of denning polar bears in Alaska. *Arctic* 46(3): 246-250.
- Andersen, M. and J. Aars. 2008. Short-term behavioural response of polar bears (*Ursus maritimus*) to snowmobile disturbance. *Polar Biology* 31(4): 501-507.
- Arctic Council. 2009. Arctic marine shipping assessment 2009 report. Protection of the Arctic Marine Environment (PAME) Secretariat, Akureyri, Iceland.
- Arrigo, K.R., G. van Dijken and S. Pabi. 2008. Impact of a shrinking Arctic ice cover on marine primary production. *Geophysical Research Letters* 35(19):L19603.
- Atatahak, G. and V. Banci. 2001. Traditional knowledge polar bear report. Department of Sustainable Development, Kugluktuk, Nunavut, Canada.
- Atkinson, S.N. and M.A. Ramsay. 1995. The effects of prolonged fasting of the body composition and reproductive success of female polar bears (*Ursus maritimus*). *Functional Ecology* 9(4): 559-567.
- Atwood, T. C., E. Peacock, M.A. McKinney, K. Lillie, R. Wilson, D.C. Douglas, S. Miller and P. Terletzky. 2016. Rapid environmental change drives increased land use by an Arctic marine predator. *PLoS One* 11(6): e0155932.
- Barber, D. 2015. BaySys – Contributions of climate change and hydroelectric regulation to the variability and change of freshwater-marine coupling in the Hudson Bay System. An NSERC CRD collaboration between Manitoba Hydro and the Universities of Manitoba, Laval, Québec à Rimouski, Calgary, Northern British Columbia, and Trent. https://umanitoba.ca/faculties/environment/departments/ceos/media/BaySys_PROJECT_DESCRIPTION.pdf. Accessed 07 February 2020.
- Barber, D. G., H. Hop, C.J. Mundy, B. Else, I.A. Dmitrenko, J.E. Tremblay, J.K. Ehn, P. Assmy, M. Daase, L.M. Candlish and S. Rysgaard. 2015. Selected physical, biological and biogeochemical implications of a rapidly changing Arctic Marginal Ice Zone. *Progress in Oceanography* 139: 122-150.
- Bard S. 1999. Global transport of anthropogenic contaminants and the consequences for the Arctic marine ecosystem. *Marine Pollution Bulletin* 38:356–379.

- 1471 Blix, A.S. and J.W. Lentfer. 1992. Noise and vibration levels in artificial polar bear dens
1472 as related to selected petroleum exploration and development activities. *Arctic*
1473 45(1): 20-24.
- 1474 Bradley, M.J., Kutz, S.J., Jenkins, E. and O'hara, T.M., 2005. The potential impact of
1475 climate change on infectious diseases of Arctic fauna. *International Journal of*
1476 *Circumpolar Health*, 64(5), pp.468-477.
- 1477 Bunnell, F.L. and D.E.N. Tait. 1981. Population dynamics of bears - implications. Pages
1478 75-98 in C.W. Fowler and T.D. Smith, editors. *Dynamics of large mammal populations*.
1479 John Wiley and Sons, New York, USA.
- 1480 Burek, K.A., F.M.D. Gulland and T.M. O'Hara. 2008. Effects of Climate Change on
1481 Arctic Marine Mammal Health. *Ecological Applications* 18(2): S126-S134.
- 1482 Bytingsvik, J., E. Lie, J. Aars, A.E. Derocher, Ø. Wiig and B.M. Jenssen. 2012. PCBs
1483 and OH-PCBs in polar bear mother-cub pairs: A comparative study based on plasma
1484 levels in 1998 and 2008. *Science of the Total Environment* 417-418: 117-128.
- 1485 Canadian Wildlife Service. 2009. Consultations on the proposed listing of the polar bear
1486 as special concern under the Species at Risk Act. Conducted February – April 2009.
1487 Canadian Wildlife Service, Iqaluit, Nunavut, Canada.
- 1488 Cattet, M.R., Duignan, P.J., House, C.A. and St. Aubin, D.J., 2004. Antibodies to canine
1489 distemper and phocine distemper viruses in polar bears from the Canadian arctic.
1490 *Journal of Wildlife Diseases*, 40(2), pp.338-342.
- 1491 Chen, Z. C., K.G. Osadetz, H.Y. Gao, and P.K. Hannigan. 2004. An object-based model
1492 for predicting the locations of undiscovered oil and gas resources, western Sverdrup
1493 Basin, Canada. *Marine and Petroleum Geology* 21:767-777.
- 1494 CIRNAC. 2025. Impact assessments in Canada's North. Crown Indigenous Relations
1495 and Northern Affairs Canada. [https://www.rcaanc-](https://www.rcaanc-cirnac.gc.ca/eng/1466431262580/1547478287247?wbdisable=true)
1496 [cirnac.gc.ca/eng/1466431262580/1547478287247?wbdisable=true](https://www.rcaanc-cirnac.gc.ca/eng/1466431262580/1547478287247?wbdisable=true). Accessed 15 April
1497 2025.
- 1498 Clark, D.A., F.M. van Beest and R.K. Brook. 2012. Polar bear-human conflicts: state of
1499 knowledge and research needs. *Canadian Wildlife Biology and Management*
1500 1(1): 21-29.
- 1501 CNLOPB (Canada-Newfoundland and Labrador Offshore Petroleum Board) 2018.
1502 Strategic Assessment for the Labrador Shelf and Eastern Newfoundland Areas.
1503 <http://www.cnlopb/sea/>. Accessed 07 February 2020.

- 1504 Cohen, A.A. 2004. Female post-reproductive lifespan: a general mammalian trait.
1505 Biological Reviews 79(4): 733-750.
- 1506 COSEWIC. 2018. COSEWIC assessment and status report on the Polar Bear *Ursus*
1507 *maritimus* in Canada. Committee on the Status of Endangered Wildlife in Canada,
1508 Ottawa, Ontario, Canada.
- 1509 DeMaster, D.P., C.W. Fowler, S.L. Perry and M.F. Richlen. 2001. Predation and
1510 Competition: The Impact of Fisheries on Marine-Mammal Populations Over the Next
1511 One Hundred Years. Journal of Mammalogy 82(3): 641-651.
- 1512 Derksen, C., D. Burgess, C. Duguay, S. Howell, L. Mudryk, S. Smith, C. Thackeray and
1513 M. Kirchmeier-Young. 2019. Changes in snow, ice, and permafrost across Canada.
1514 Pages 194-260 in E. Bush and D.S. Lemmen, editors. Canada's Changing Climate
1515 Report. Government of Canada, Ottawa, Ontario, Canada.
- 1516 Derocher, A.E., H. Wolkers, T. Colborn, M. Schlabach, T.S. Lauren and Ø. Wiig. 2003.
1517 Contaminants in Svalbard polar bear samples archived since 1967 and possible
1518 population effects. Science of the Total Environment 301(1-3): 163-174.
- 1519 Derocher, A.E., N.J. Lunn and I. Stirling. 2004. Polar bears in a warming climate.
1520 Integrative and Comparative Biology 44(2): 163-176.
- 1521 Dietz, R., F. Riget, E.W. Born, C. Sonne, P. Grandjean, M. Kirkegaard, M.T. Olsen,
1522 G. Asmund, A. Renzoni, H. Baagøe and C. Andreassen. 2006. Trends in mercury in hair
1523 of Greenlandic polar bears (*Ursus maritimus*) during 1892-2001. Environmental Science
1524 & Technology 40(4): 1120-1125.
- 1525 Dietz, R., K. Gustavson, C. Sonne, J.P. Desforjes, F.F. Rigét, V. Pavlova,
1526 M.A. McKinney and R.J. Letcher. 2015. Physiologically-based pharmacokinetic
1527 modelling of immune, reproductive and carcinogenic effects from contaminant exposure
1528 in polar bears (*Ursus maritimus*) across the Arctic. Environmental Research 140: 45-55.
- 1529 Dowsley, M. 2007. Inuit perspectives on polar bears (*Ursus maritimus*) and climate
1530 change in Baffin Bay, Nunavut, Canada. Research and Practice in Social Sciences
1531 2: 53-74.
- 1532 Dowsley, M. and G. Wenzel. 2008. "The Time of the Most Polar Bears": A
1533 Co-Management Conflict in Nunavut. Arctic 61(2): 177-189.
- 1534 Durner, G.M., S.C. Amstrup and T.L. McDonald. 2000. Estimating the impacts of oil
1535 spills on polar bears. Arctic Research of the United States 14: 33-37.
- 1536 Durner, G.M., J.P. Whiteman, H.J. Harlow, S.C. Amstrup, E.V. Regehr and
1537 M. Ben-David. 2011. Consequences of long-distance swimming and travel over
1538 deep-water pack ice for a female polar bear during a year of extreme sea ice retreat.
1539 Polar Biology 34: 975-984.

- 1540 Dyck, M.G. and R.K. Baydack. 2004. Vigilance behaviour of polar bears (*Ursus*
1541 *maritimus*) in the context of wildlife-viewing activities at Churchill, Manitoba, Canada.
1542 Biological Conservation 116(3): 343-350.
- 1543 Dyck, M.G. 2006. Characteristics of polar bears killed in defense of life and property in
1544 Nunavut, Canada, 1970-2000. *Ursus* 17(1): 52-62.
- 1545 ECCC. 2004. An invasive alien species strategy for Canada. Environment and Climate
1546 Change Canada. Ottawa, Ontario, Canada.
- 1547 ECCC. 2017. Persistent Organic Pollutants: Stockholm Convention. Environment and
1548 Climate Change Canada. [https://www.canada.ca/en/environment-climate-](https://www.canada.ca/en/environment-climate-change/corporate/international-affairs/partnerships-organizations/persistent-organic-pollutants-stockholm-convention.html)
1549 [change/corporate/international-affairs/partnerships-organizations/persistent-organic-](https://www.canada.ca/en/environment-climate-change/corporate/international-affairs/partnerships-organizations/persistent-organic-pollutants-stockholm-convention.html)
1550 [pollutants-stockholm-convention.html](https://www.canada.ca/en/environment-climate-change/corporate/international-affairs/partnerships-organizations/persistent-organic-pollutants-stockholm-convention.html). Accessed 07 February 2020.
- 1551 ECCC. 2018b. Pan-Canadian Approach to Wildlife Health. Environment and Climate
1552 Change Canada, Gatineau, Québec, Canada.
- 1553 ECCC. 2020. Conservation of polar bears in Canada. Environment and Climate Change
1554 Canada. [https://www.canada.ca/en/services/environment/wildlife-plants-species/wildlife-](https://www.canada.ca/en/services/environment/wildlife-plants-species/wildlife-habitat-conservation/conservation-polar-bears.html)
1555 [habitat-conservation/conservation-polar-bears.html](https://www.canada.ca/en/services/environment/wildlife-plants-species/wildlife-habitat-conservation/conservation-polar-bears.html) Accessed 16 April 2025.
- 1556 ECCC. 2023. Maps of subpopulations of polar bears and protected areas. Environment
1557 and Climate Change Canada. [https://www.canada.ca/en/environment-climate-](https://www.canada.ca/en/environment-climate-change/services/species-risk-public-registry/related-information/maps-sub-populations-polar-bears-protected.html)
1558 [change/services/species-risk-public-registry/related-information/maps-sub-populations-](https://www.canada.ca/en/environment-climate-change/services/species-risk-public-registry/related-information/maps-sub-populations-polar-bears-protected.html)
1559 [polar-bears-protected.html](https://www.canada.ca/en/environment-climate-change/services/species-risk-public-registry/related-information/maps-sub-populations-polar-bears-protected.html). Accessed 16 April 2025.
- 1560 ECCC. 2024. At a glance: Canada's international action on climate change, biodiversity
1561 loss and pollution. Environment and Climate Change Canada.
1562 [https://www.canada.ca/en/services/environment/weather/climatechange/canada-](https://www.canada.ca/en/services/environment/weather/climatechange/canada-international-action.html)
1563 [international-action.html](https://www.canada.ca/en/services/environment/weather/climatechange/canada-international-action.html). Accessed April 16 2025.
- 1564 Ferguson, S.H., I. Stirling and P. McLoughlin. 2005. Climate change and ringed seal
1565 (*Phoca hispida*) recruitment in western Hudson Bay. Marine Mammal Science
1566 21(1): 121-135.
- 1567 Fox, C.W. and Messina, F.J. 2013. Life History. Oxford Bibliographies Online in
1568 Ecology. [https://www.oxfordbibliographies.com/view/document/obo-](https://www.oxfordbibliographies.com/view/document/obo-9780199830060/obo-9780199830060-0016.xml)
1569 [9780199830060/obo-9780199830060-0016.xml](https://www.oxfordbibliographies.com/view/document/obo-9780199830060/obo-9780199830060-0016.xml). Accessed 08 August 2020.
- 1570 Freeman, M.M.R. and G.W. Wenzel. 2006. The nature and significance of polar bear
1571 conservation hunting in the Canadian Arctic. *Arctic* 59(1): 21-30.

- 1572 Gabrielsen, K.M., J.S. Krokstad, M.J. Obregon, G.D. Villanger, C. Sonne, R. Dietz and
1573 B.M. Jenssen. 2015. Thyroid hormones and deiodinase activities in plasma and tissues
1574 from East Greenland polar bears (*Ursus maritimus*) during winter season. Polar Biology
1575 38(8): 1285-1296.
- 1576 Galicia, M.P., Thiemann, G.W., Dyck, M.G., Ferguson, S.H. and Higdon, J.W., 2016.
1577 Dietary habits of polar bears in Foxe Basin, Canada: possible evidence of a trophic
1578 regime shift mediated by a new top predator. Ecology and evolution, 6(16),
1579 pp. 6005-6018.
- 1580 Gautier, D.L., Bird, K.J, Charpentier, R.R., Grantz, A., Houseknecht, D.W., Klett, T.R.,
1581 Moore, T.E., Pitman, J.K., Schenk, C.J., Schuenemeyer, J.H., Sørensen, K., Tennyson,
1582 M.E., Valin, Z.C., and Wandrey, C.J. 2009. Assessment of undiscovered oil and gas in
1583 the Arctic. Science 324:1175-1179.
- 1584 Gormezano, L. J. and R.F. Rockwell. 2013. What to eat now? Shifts in polar bear diet
1585 during the ice-free season in western Hudson Bay. Ecology and Evolution
1586 3(10): 3509-3523.
- 1587 Government of Canada. 2009. Summary of the National Roundtable on Polar Bears.
1588 Species at Risk Public Registry.
1589 https://www.sararegistry.gc.ca/virtual_sara/files/ri_polar_bear_0209_e.pdf. Accessed
1590 07 February 2020.
- 1591 Government of Canada. 2017a. Polar Bear Export: Information Note: Convention on
1592 international trade in endangered species of wild fauna and flora (CITES). Government
1593 of Canada. [https://www.canada.ca/en/environment-climate-change/services/convention-](https://www.canada.ca/en/environment-climate-change/services/convention-international-trade-endangered-species/non-detriment-findings/polar-bear-export-information-note.html)
1594 [international-trade-endangered-species/non-detriment-findings/polar-bear-export-](https://www.canada.ca/en/environment-climate-change/services/convention-international-trade-endangered-species/non-detriment-findings/polar-bear-export-information-note.html)
1595 [information-note.html](https://www.canada.ca/en/environment-climate-change/services/convention-international-trade-endangered-species/non-detriment-findings/polar-bear-export-information-note.html). Accessed 06 February 2020.
- 1596 Government of Canada. 2017b. Trade in protected species: frequently asked questions.
1597 Government of Canada. [https://www.canada.ca/en/environment-climate-](https://www.canada.ca/en/environment-climate-change/services/convention-international-trade-endangered-species/frequently-asked-questions.html#_01_1)
1598 [change/services/convention-international-trade-endangered-species/frequently-asked-](https://www.canada.ca/en/environment-climate-change/services/convention-international-trade-endangered-species/frequently-asked-questions.html#_01_1)
1599 [questions.html#_01_1](https://www.canada.ca/en/environment-climate-change/services/convention-international-trade-endangered-species/frequently-asked-questions.html#_01_1). Accessed 07 February 2020.
- 1600 Government of Canada. 2018. Permits for trade in protected species. Government of
1601 Canada. [https://www.canada.ca/en/environment-climate-change/services/convention-](https://www.canada.ca/en/environment-climate-change/services/convention-international-trade-endangered-species/permits.html)
1602 [international-trade-endangered-species/permits.html](https://www.canada.ca/en/environment-climate-change/services/convention-international-trade-endangered-species/permits.html). Accessed 07 February 2020.
- 1603 Government of Canada. 2019. Northern Contaminants Program: What is the Northern
1604 Contaminants Program? Government of Canada.
1605 http://www.science.gc.ca/eic/site/063.nsf/eng/h_7A463DBA.html. Accessed 07 February
1606 2020.

- 1607 Government of Nunavut. 2018. Nunavut Polar Bear Co-Management Plan. Government
1608 of Nunavut. <https://www.nwmb.com/en/public-hearings-a-meetings/public-hearings-1/2018/nwmb-in-person-public-hearing-to-consider-the-government-of-nunavut-proposal-on-the-revised-nunavut-polar-bear-co-management-plan-2/proposal-for-decision-4>. Accessed 07 February 2020.
- 1612 Government of Ontario. 2017. Guide to Environmental Assessment Requirements for
1613 Electricity Projects. Government of Ontario. <https://www.ontario.ca/page/guide-environmental-assessment-requirements-electricity-projects>. Accessed 07 February
1614 2020.
- 1616 Hart, E.J. and B. Amos. 2004. Learning about marine resources and their use through
1617 Inuvialuit oral history. Report prepared for the Beaufort Sea Integrated Management
1618 Planning Initiative Working Group, Inuvialuit Cultural Resource Centre, Inuvik, NT.
- 1619 Henri, D. 2010. Combining Aboriginal Traditional Ecological Knowledge and Western
1620 Science for Polar Bear Research and Management in Canada: A Critical Review.
1621 Unpublished report for Environment Canada.
- 1622 Henri, D. 2012. Managing Nature, Producing Cultures: Inuit Participation, Science, and
1623 Policy in Wildlife Governance in the Nunavut Territory, Canada. Unpublished Doctoral
1624 thesis <https://ora.ox.ac.uk/objects/uuid:2cde7bcb-4818-4f61-9562-179b4ee74fee>.
- 1625 Hurst, R.J., P.D. Watts and N.A. Øritsland. 1991. Metabolic compensation in oil
1626 exposed polar bears. *Journal of Thermal Biology* 16(1): 53-56.
- 1627 IAA. 2019. Basics of Environmental Assessment. Government of Canada.
1628 [https://www.canada.ca/en/impact-assessment-agency/services/environmental-](https://www.canada.ca/en/impact-assessment-agency/services/environmental-assessments/basics-environmental-assessment.html)
1629 [assessments/basics-environmental-assessment.html](https://www.canada.ca/en/impact-assessment-agency/services/environmental-assessments/basics-environmental-assessment.html). Accessed 17 February 2020.
- 1630 IAA 2025. Purpose and benefits of impact assessments. Government of Canada.
1631 [https://www.canada.ca/en/impact-assessment-agency/programs/impact-assessments-](https://www.canada.ca/en/impact-assessment-agency/programs/impact-assessments-101/purpose-benefits-impact-assessments.html)
1632 [101/purpose-benefits-impact-assessments.html](https://www.canada.ca/en/impact-assessment-agency/programs/impact-assessments-101/purpose-benefits-impact-assessments.html). Accessed April 17 2025.
- 1633 International Maritime Organization. No date. How the Polar Code Protects the
1634 Environment. International Maritime Organization.
1635 [https://wwwcdn.imo.org/localresources/en/MediaCentre/HotTopics/Documents/How%20](https://wwwcdn.imo.org/localresources/en/MediaCentre/HotTopics/Documents/How%20the%20Polar%20Code%20protects%20the%20environment%20(English%20infographic).pdf)
1636 [the%20Polar%20Code%20protects%20the%20environment%20\(English%20infographi](https://wwwcdn.imo.org/localresources/en/MediaCentre/HotTopics/Documents/How%20the%20Polar%20Code%20protects%20the%20environment%20(English%20infographic).pdf)
1637 [c\).pdf](https://wwwcdn.imo.org/localresources/en/MediaCentre/HotTopics/Documents/How%20the%20Polar%20Code%20protects%20the%20environment%20(English%20infographic).pdf). Accessed 17 April 2025.
- 1638 IPCC. 2013. Climate Change 2013: The Physical Basis. Contributions of Working Group
1639 1 to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change.
1640 Edited by: T.F. Stoker, D. Qin, G.K. Plattner, M.M.B. Tignor, S.K. Allen, J. Boschung,

- 1641 A. Nauels, Y. Xia, V. Bex and P.M. Midgley, editors. Cambridge University Press,
1642 Cambridge, UK.
- 1643 IUCN/SSC Polar Bear Specialist Group. 2024.[https://www.iucn-pbsg.org/population-](https://www.iucn-pbsg.org/population-status/)
1644 [status/](https://www.iucn-pbsg.org/population-status/). IUCN/SSC Polar Bear Specialist Group. Accessed April 17 2025.
- 1645 Iversen, M., J. Aars, T. Haug, I.G. Alsos, C. Lydersen, L. Bachmann and K.M. Kovacs.
1646 2013. The diet of polar bears (*Ursus maritimus*) from Svalbard, Norway, inferred from
1647 scat analysis. Polar Biology 36(4): 561-571.
- 1648 Jenssen, B.M., G.D. Villanger, K.M. Gabrielsen, J. Bytingsvik, T. Bechsoft,
1649 T.M. Ciesielski, C. Sonne and R. Dietz. 2015. Anthropogenic flank attack on polar
1650 bears: interacting consequences of climate warming and pollutant exposure. Frontiers
1651 in Ecology and Evolution 3(16).
- 1652 Jessen, S., R. Jameson, R. Clowater and M. Borland. No date. Protection Standards for
1653 Marine Protected Areas (MPAs) in Canada. Canadian Parks and Wilderness Society.
1654 [https://www.dfo-mpo.gc.ca/oceans/documents/conservation/advisorypanel-](https://www.dfo-mpo.gc.ca/oceans/documents/conservation/advisorypanel-comiteconseil/submissions-soumises/CPAWS-MinimumStandards-WrittenSubmission-Final.pdf)
1655 [comiteconseil/submissions-soumises/CPAWS-MinimumStandards-WrittenSubmission-](https://www.dfo-mpo.gc.ca/oceans/documents/conservation/advisorypanel-comiteconseil/submissions-soumises/CPAWS-MinimumStandards-WrittenSubmission-Final.pdf)
1656 [Final.pdf](https://www.dfo-mpo.gc.ca/oceans/documents/conservation/advisorypanel-comiteconseil/submissions-soumises/CPAWS-MinimumStandards-WrittenSubmission-Final.pdf). Accessed on 07 February 2020.
- 1657 Joint Secretariat. 2015. Inuvialuit and Nanuq: A polar bear traditional knowledge study.
1658 Joint Secretariat, Inuvik, Northwest Territories, Inuvialuit Settlement Region, Canada.
- 1659 Joint Secretariat. 2017. Inuvialuit Settlement Region Polar Bear Joint Management
1660 Plan. Joint Secretariat, Inuvik, Northwest Territories, Inuvialuit Settlement Region,
1661 Canada.
- 1662 Keith, D. 2005. Inuit Qaujimaningit Nanurnut Inuit knowledge of Polar Bears. CCI Press,
1663 Edmonton, Alberta, Canada.
- 1664 Kendrick, A. 2013. Canadian Inuit sustainable use and management of Arctic species.
1665 International Journal of Environmental Studies 70:414-428.
- 1666 Kingsley, M.C.S., I. Stirling and W. Calvert. 1985. The distribution and abundance of
1667 seals in the Canadian High Arctic, 1980-82. Canadian Journal of Fisheries and Aquatic
1668 Sciences 42(6): 1189-1210.
- 1669 Kotierk, M. 2010. The documentation of Inuit and public knowledge of Davis Strait polar
1670 bears, climate change, Inuit knowledge and environmental management using public
1671 opinion polls. Department of Environment, Government of Nunavut, Iqaluit, Nunavut,
1672 Canada.
- 1673 Kovacs, K.M., C. Lydersen, J.E. Overland, and S.E. Moore. 2010. Impacts of changing sea
1674 ice conditions on Arctic marine mammals. Marine Biodiversity 41: 181-194.

- 1675 Kutz, S.J., S. Checkley, G.G. Verocai, M. Dumond, E.P. Hoberg, R. Peacock, J.P. Wu,
1676 K. Orsel, K. Seegers, A.L. Warren and A. Abrams. 2013. Invasion, establishment, and
1677 range expansion of two parasitic nematodes in the Canadian Arctic. *Climate Change*
1678 *Biology* 19(11): 3254-3262.
- 1679 Laforest, B., J. Hebert, M. Obbard and G. Thiemann. 2018. Traditional ecological
1680 knowledge of polar bears in the Northern Eeyou Marine Region, Québec, Canada.
1681 *Arctic* 71(1): 40-58.
- 1682 Laidre, K.L., I. Stirling, L.F. Lowry, Ø. Wiig, M.P. Heide-Jørgensen and S.H. Ferguson.
1683 2008. Quantifying the sensitivity of arctic marine mammals to climate-induced habitat
1684 change. *Ecological Applications* 18(sp2): S97-S125.
- 1685 Laidre, K.L., S. Atkinson, E.V. Regehr, H.L. Stern, E.W. Born, Ø. Wiig, N.J. Lunn and
1686 M. Dyck. 2020. *Ecological Applications* 0(0): e02071.
- 1687 Lemelin, R.H. 2006. The gawk, the glance, and the gaze: ocular consumption and polar
1688 bear tourism in Churchill, Manitoba, Canada. *Current Issues in Tourism* 9(6):516-534.
- 1689 Lemelin, R.H., M. Dowsley, B. Walmark, F. Siebel, L. Bird, G. Hunter, T. Myles,
1690 M. Mack, M. Gull, M. Kakekaspan, The Washaho First Nation at Fort Severn and The
1691 Weenusk First Nation at Peawanuck. 2010. Wabusk of the Omushkegouk: Cree-polar
1692 bear (*Ursus maritimus*) interactions in northern Ontario. *Human Ecology* 38(6): 803-815.
- 1693 Letcher, R. J., J.O. Bustnes, R. Dietz, B.M. Jenssen, E.H. Jørgensen, C. Sonne,
1694 J. Verreault, M.M. Vijayan and G.W. Gabrielsen. 2010. Exposure and effects
1695 assessment of persistent organic pollutants in Arctic wildlife and fish. *Science of the*
1696 *Total Environment* 408(15): 2995-3043.
- 1697 Letcher, R.J., A.D. Morris, M. Dyck, E. Sverko, E.J. Reiner, D.A.D. Blair, S.G. Chu and
1698 L. Shen. 2018. Legacy and new halogenated persistent organic pollutants in polar bears
1699 from a contamination hotspot in the Arctic, Hudson Bay Canada. *Science of the Total*
1700 *Environment* 610-611: 121-136.
- 1701 Linnell, J.D.C., J.E. Swenson, R. Andersen and B. Barnes. 2000. How vulnerable are
1702 denning bears to disturbance? *Wildlife Society Bulletin* 28(2): 400-413.
- 1703 Lunn, N.J., S. Schliebe and E.W. Born. 2002. Polar Bears: Proceedings of the 13th
1704 Working Meeting of the IUCN/SSC Polar Bear Specialist Group, Nuuk, Greenland.
1705 IUCN, Gland, Switzerland and Cambridge, UK.
- 1706 Lunn, N.J., M. Branigan, L. Carpenter, J. Justus, D. Hedman, D. Larsen, S. Lefort,
1707 R. Maraj, M.E. Obbard, L. Peacock and F. Pokiak. 2010. Polar bear management in
1708 Canada, 2005–2008. In *Polar bears: Proceedings of the 15th Working Meeting of the*

- 1709 IUCN/SSC Polar Bear Specialist Group, Copenhagen, Denmark, 29 June–3 July 2009.
1710 Pages 87–113 in M.E. Obbard, G.W. Thiemann, E. Peacock and T.D. DeBruyn, editors.
1711 Occasional Paper of the IUCN Species Survival Commission No. 43. IUCN, Gland,
1712 Switzerland.
- 1713 Makivik Corporation. 2001. South Hudson Bay Polar Bear traditional Inuit knowledge.
1714 Taken from interviews to inform land use and occupancy study, 1980-2001. Makivik
1715 Corporation, Kuujuaq, Québec, Canada.
- 1716 McDonald, M., L. Arragutainaq and Z. Novalinga. 1997. Voices from the Bay: traditional
1717 ecological knowledge of Inuit and Cree in the Hudson Bay bioregion. Canadian Arctic
1718 Resources Committee, Ottawa, Canada.
- 1719 McKinney, M.A., I. Stirling, N.J. Lunn, E. Peacock and R.J. Letcher. 2010. The role of
1720 diet on long-term concentration and pattern trends of brominated and chlorinated
1721 contaminants in western Hudson Bay polar bears, 1991-2007. *Science of the Total*
1722 *Environment* 408(24): 6210-6222.
- 1723 Miller, S., Wilder, J., Wilson, R.R. 2015. Polar bear-grizzly bear interactions during the
1724 autumn open-water period in Alaska. *Journal of Mammalogy* 96:1317-1325.
- 1725 Molnár, P.K., A.E. Derocher and M.A. Lewis. 2007. Modeling the impact of sex-selective
1726 harvesting and climate change on the polar bear mating system: A mechanistic approach to the
1727 Allee effect. *Ecological Society of America Annual Meeting Abstracts*. 2007.
- 1728 Molnár, P.K., A.E. Derocher, M.A. Lewis and M.K. Taylor. 2008. Modelling the mating
1729 system of polar bears: a mechanistic approach to the Allee effect. *Proceedings of the*
1730 *Royal Society B-Biological Sciences* 275: 217-226.
- 1731 Molnár, P.K., A.E. Derocher, G.W. Thiemann, and M.A. Lewis. 2010. Predicting
1732 survival, reproduction and abundance of polar bears under climate change. *Biological*
1733 *Conservation* 143(7): 1612-1622.
- 1734 Molnár, P.K., A.E. Derocher, G.W. Thiemann, and M.A. Lewis. 2014. Corrigendum to
1735 “Predicting survival, reproduction and abundance of polar bears under climate change”
1736 [*Biol. Conserv.* 143 (2010) 1612–1622]. *Biological Conservation* 177: 230-231.
- 1737 Monnett, C. and J.S. Gleason. 2006. Observations of mortality associated with
1738 extended open-water swimming by polar bears in the Alaskan Beaufort Sea. *Polar*
1739 *Biology* 29(8): 681-687.

- 1740 Nirlungayuk, G. and D. Lee. 2009. A Nunavut Inuit perspective on Western Hudson
1741 Bay polar bear management and the consequences for conservation hunting.
1742 Pages 135-142 in M. Freeman and A.L. Foote, editors. Inuit, Polar Bears, and
1743 Sustainable Use CCI Press, Edmonton, Alberta, Canada.
- 1744 NMRWB. 2018. Nunavik Inuit Knowledge and Observations of Polar Bears: Polar bears
1745 of the Southern Hudson Bay sub-population. Nunavik Marine Region Wildlife Board,
1746 Inukjuak, Québec, Canada.
- 1747 Norstrom, R.J., S.E. Belikov, E.W. Born, G.W. Garner, B. Malone, S. Olpinski,
1748 M.A. Ramsay, S. Schliebe, I. Stirling, M.S. Stishov, M.K. Taylor and Ø. Wiig. 1998.
1749 Chlorinated hydrocarbon contaminants in polar bears from eastern Russia, North
1750 America, Greenland, and Svalbard: Biomonitoring of Arctic pollution. Archives of
1751 Environmental Contamination and Toxicology 35(2): 354-367.
- 1752 Obbard, M.E., G.W. Thiemann, E. Peacock and T.D. DeBruyn. 2010. Polar Bears:
1753 Proceedings of the 15th Working Meeting of the IUCN/SSC Polar Bear Specialist
1754 Group, Copenhagen, Denmark, 29 June–3 July 2009. Gland, Switzerland and
1755 Cambridge, UK.
- 1756 Orihel, D., J. Provencher and M. Dias. 2019. Queen's Experimental Ecology &
1757 Ecotoxicology Study Plan: A pilot study to explore the use of scat analysis as a means
1758 of evaluating exposure of Polar Bears (*Ursus maritimus*) to plastics.
- 1759 Pagano, A.M., G.M. Durner, S.C. Amstrup, K.S. Simac and G.S. York. 2012. Long-
1760 distance swimming by polar bears (*Ursus maritimus*) of the southern Beaufort Sea
1761 during years of extensive open water. Canadian Journal of Zoology 90(5): 663-676.
- 1762 Parks Canada. 2018a. National Marine Conservation Areas. Parks Canada.
1763 <https://www.pc.gc.ca/en/amnc-nmca/introduction>. Accessed 07 February 2020.
- 1764 Parks Canada. 2018b. Ukkusiksalik National Park of Canada Management Plan. Parks
1765 Canada. [https://parks.canada.ca/pn-np/nu/ukkusiksalik/info/plan/gestion-management-](https://parks.canada.ca/pn-np/nu/ukkusiksalik/info/plan/gestion-management-2018)
1766 [2018](https://parks.canada.ca/pn-np/nu/ukkusiksalik/info/plan/gestion-management-2018) . Accessed 17 April 2025.
- 1767 Patyk, K.A., C. Duncan, P. Nol, C. Sonne, K. Laidre, M. Obbard, Ø. Wiig, J. Aars,
1768 E. Regehr, L.L. Gustafson and T. Atwood. 2015. Establishing a definition of polar bear
1769 (*Ursus maritimus*) health: A guide to research and management activities. Science of
1770 the Total Environment 514: 371-378.
- 1771 PBAC. 2011. National Polar Bear Conservation Strategy for Canada. Polar Bear
1772 Administrative Committee. [https://polarbearagreement.org/resources/individual-range-](https://polarbearagreement.org/resources/individual-range-state-action-plans/canada)
1773 [state-action-plans/canada](https://polarbearagreement.org/resources/individual-range-state-action-plans/canada). Accessed 07 February 2020.

- 1774 Peacock, E., A.E. Derocher, G.W. Thiemann, and I. Stirling. 2011. Conservation and
1775 management of Canada's polar bears (*Ursus maritimus*) in a changing Arctic. Canadian
1776 Journal of Zoology 89:371-385.
- 1777 Pilfold, N.W., A.E. Derocher, I. Stirling and E. Richardson. 2015. Multi-temporal factors
1778 influence predation for polar bears in a changing climate. Oikos 124(8):1098-1107.
- 1779 Pilfold, N.W., D. Hedman, I. Sterling, A.E. Derocher, N.J. Lunn and E. Richardson.
1780 2016a. Mass loss rates of fasting polar bears. Physiological and Biochemical Zoology
1781 89(5): 377–388.
- 1782 Pilfold, N.W., A. McCall, A.E. Derocher, N.J. Lunn and E. Richardson. 2016b.
1783 Migratory response of polar bears to sea ice loss: to swim or not to swim. Ecology
1784 40(1):189-199.
- 1785 Pilfold, N.W., E.S. Richardson, J. Ellis, E. Jenkins, W. B. Scandrett, A. Hernández-Ortiz,
1786 K. Buhler, D. McGeachy, B. Al-Adhami, K. Konecsni, V.A. Lobanov, M.A. Owen, B.
1787 Rideout and N.J. Lunn. 2021. Long-term increases in pathogen seroprevalence in polar
1788 bears (*Ursus maritimus*) influenced by climate change. Global Change Biology
1789 27(19):4481-4497.
- 1790 Polar Bear Range States. 2015. Circumpolar Action Plan: Conservation Strategy for
1791 Polar Bears. A product of the representatives of the parties to the 1973 Agreement on
1792 the Conservation of Polar Bears.
- 1793 Polischuk, S.C., R.J. Norstrom, and M.A. Ramsay. 2002. Body burdens and tissue
1794 concentrations of organochlorines in polar bears (*Ursus maritimus*) vary during
1795 seasonal fasts. Environmental Pollution 118(1): 29-39.
- 1796 Prestrud, P. and I. Stirling. 1994. The International Polar Bear Agreement and the
1797 current status of polar bear conservation. Aquatic Mammals 20(3): 113-124.
- 1798 Prowse, T.D., C. Furgal, R. Chouinard, H. Melling, D. Milburn and S.L. Smith. 2009.
1799 Implications of Climate Change for Economic Development in Northern Canada:
1800 Energy, Resource, and Transportation Sectors. Ambio 38(5): 272-281.
- 1801 Ramsay, M.A. and I. Stirling. 1988. Reproductive biology and ecology of female polar
1802 bears (*Ursus maritimus*). Journal of Zoology 214(4): 601-633.
- 1803 Robbins, C.T., C. Lopez-Alfaro, K.D. Rode, Ø. Tøien and O.L. Nelson. 2012.
1804 Hibernation and seasonal fasting in bears: the energetic costs and consequences for
1805 polar bears. Journal of Mammalogy 93(6): 1493-1503.

- 1806 Rode, K.D., C.T. Robbins, L. Nelson and S.C. Amstrup. 2015. Can polar bears use
1807 terrestrial foods to offset lost ice-based hunting opportunities? *Frontiers in Ecology and*
1808 *the Environment* 13(3): 138-145.
- 1809 Rode, K. D., J.K. Fortin-Noreus, D. Garshelis, M. Dyck, V. Sahanatien, T. Atwood,
1810 S. Belikov, K.L. Laidre, S. Miller, M.E. Obbard, D. Vongraven, J. Ware and J. Wilder.
1811 2018. Survey-based assessment of the frequency and potential impacts of recreation on
1812 polar bears. *Biological Conservation* 227:121-132.
- 1813 Routti, H., T.C. Atwood, T. Bechshoft, A. Boltunov, T.M. Ciesielski, J.P. Desforges,
1814 R. Dietz, G.W. Gabrielsen, B.M. Jenssen, R.J. Letcher, M.A. McKinney, A.D. Morris,
1815 F.F. Rigét, C. Sonne, B. Styriahave and S. Tartu. 2019. State of knowledge on current
1816 exposure, fate and potential health effects of contaminants in polar bears from the
1817 circumpolar Arctic. *Science of the Total Environment* 664: 1063-1083
- 1818 Sahanatien, V. and A.E. Derocher. 2012. Monitoring sea ice habitat fragmentation for
1819 polar bear conservation. *Animal Conservation* 15(4): 397-406.
- 1820 Saladin d'Anglure, B. 1990. Nanook, Super-mâle: The Polar Bear in the Imaginary
1821 Space and Social Time of the Inuit of the Canadian Arctic. In: Willis, R. (ed.). *Signifying*
1822 *Animals: Human Meaning in the Natural World*. London: Routledge, pp. 178 – 195.
- 1823 Salafsky, N., D. Salzer, A. J. Stattersfield, C. Hilton-Taylor, R. Neugarten,
1824 S. H. M. Butchart, B. Collen, N. Cox, L. L. Master, S. O'Connor, and D. Wilkie. 2008.
1825 A standard lexicon for biodiversity conservation: unified classifications of threats and
1826 actions. *Conservation Biology* 22:897-911. (Classification online at
1827 <http://conservationmeasures.org/CMP/IUCN/browse.cfm?TaxID=DirectThreats>.)
- 1828 Schliebe, S., K.D. Rode, J.S. Gleason, J. Wilder, K. Proffitt, T.J. Evans and S. Miller.
1829 2008. Effects of sea ice extent and food availability on spatial and temporal distribution
1830 of polar bears during the fall open-water period in the Southern Beaufort Sea. *Polar*
1831 *Biology* 31(8):999-1010.
- 1832 Schuster, P.F., K.M. Schaefer, G.R. Aiken, R.C. Antweiler, J.F. Dewild, J.D. Gryziec,
1833 A. Gusmeroli, G. Hugelius, E. Jafarov, D.P. Krabbenhoft, L. Liu, N. Herman-Mercer,
1834 C. Mu, D.A. Roth, T. Schaefer, R.G. Striegl, K.P. Wickland, and T. Zhang. 2018.
1835 Permafrost stores a globally significant amount of mercury. *Geophysical Research*
1836 *Letters*, 45(3): 1463-1471.
- 1837 Schweinsburg, R.E. and L.J. Lee. 1982. Movement of four satellite-monitored polar
1838 bears in Lancaster Sound, Northwest Territories. *Arctic* 35(4): 504-511.

- 1839 Schweinsburg, R.E., L.J. Lee and P.B. Latour. 1982. Distribution, movement and
1840 abundance of polar bears in Lancaster Sound, Northwest Territories. *Arctic*
1841 35(1): 159-169.
- 1842 Sciullo, L., G.W. Thiemann and N.J. Lunn. 2016. Comparative assessment of metrics
1843 for monitoring the body condition of polar bears in western Hudson Bay. *Journal of*
1844 *Zoology* 300(1): 45-58.
- 1845 Slavik, D., Wildlife Management Advisory Councils (NWT and North Slope) and
1846 Inuvialuit Game Council. 2009. Inuvialuit Knowledge of Nanuq: Community and
1847 Traditional Knowledge of Polar Bears in the Inuvialuit Settlement Region. Report and
1848 Unpublished Transcripts. Inuvialuit Joint Secretariat, Inuvik, NT. 67 pp.
- 1849 Slavik, D. 2010. Inuvialuit knowledge of nanuq: Community and traditional knowledge of
1850 Polar Bears in the Inuvialuit Settlement Region. Wildlife Management Advisory Council
1851 (NWT), Wildlife Management Advisory Council (NS), and Inuvialuit Game Council,
1852 Inuvik, Northwest Territories, Canada.
- 1853 Slavik, D. 2013. Knowing Nanuut: Banks Islanders knowledge and indicators of Polar
1854 Bear population health. University of Alberta, Edmonton, Alberta, Canada.
- 1855 Smith, L.C. and S.R. Stephenson. 2013. New Trans-Arctic shipping routes navigable by
1856 midcentury. *Proceedings of the National Academy of Sciences of the United States of*
1857 *America* 110(13): E1191-1195.
- 1858 Sonne, C. 2010. Health effects from long-range transported contaminants in Arctic top
1859 predators: An integrated review based on studies of polar bears and relevant model
1860 species. *Environment International* 36(5): 461-491.
- 1861 Sonne, C., T. Iburg, P.S. Leifsson, E.W. Born, R.J. Letcher and R. Dietz. 2011. Thyroid
1862 gland lesions in organohalogen contaminated East Greenland polar bears (*Ursus*
1863 *maritimus*). *Toxicological and Environmental Chemistry* 93(4): 789-805.
- 1864 SOR/2011-233, October 27, 2011, Order Amending Schedule I of the Species at Risk
1865 Act, Canada Gazette Part II, Vol. 145, No. 23. Pp 2282 – 2311.
- 1866 Species at Risk Committee. 2021. Species Status Report for Polar Bear (*Ursus*
1867 *maritimus*) in the Northwest Territories. Species at Risk Committee, Yellowknife, NT.
- 1868 *Species At Risk Act*: Order Amending Schedule 1 to the Species at Risk Act. (2011).
1869 Canada Gazette Part I, 145(27). Retrieved from:
1870 <http://sararegistry.gc.ca/default.asp?lang=En&n=B63B5ED3-1#REF61>

- 1871 Stenhouse, G.B., L.J. Lee and K.G. Poole. 1988. Some characteristics of polar bears
1872 killed during conflicts with humans in the Northwest Territories, 1976-86. *Arctic*
1873 41(4):275-278.
- 1874 Stern, H.L. and K.L. Laidre. 2016. Sea ice indicators of polar bear habitat. *The*
1875 *Cryosphere* 10(5): 1-15.
- 1876 Stirling, I. and W.R. Archibald. 1977. Aspects of predation of seals by polar bears.
1877 *Journal of the Fisheries Research Board of Canada* 34(8): 1126-1129.
- 1878 Stirling, I., J.R. Geraci, and D.J. St. Aubin. 1990. Polar bears and oil: ecologic
1879 perspectives. Pages 223-234 in J.R. Geraci, editor. *Sea Mammals and Oil. Confronting*
1880 *the Risks*. Academic Press, San Diego, California, USA.
- 1881 Stirling, I. and N.A. Øritsland. 1995. Relationships between estimates of ringed seal
1882 (*Phoca hispida*) and polar bear (*Ursus maritimus*) populations in the Canadian Arctic.
1883 *Canadian Journal of Fisheries and Aquatic Sciences* 52(12): 2594-2612.
- 1884 Stirling, I., N.J. Lunn and S.N. Nowicki. 1997. Distribution and abundance of ringed
1885 (*Phoca hispida*) and bearded seals (*Erignathus barbatus*) in western Hudson Bay.
1886 *Canadian Journal of Fisheries and Aquatic Science* 54(4): 914- 921.
- 1887 Stirling, I., N.J. Lunn and J. Iacozza. 1999. Long-term trends in the population ecology
1888 of polar bears in western Hudson Bay in relation to climatic change. *Arctic*
1889 52(3): 294-306.
- 1890 Stirling, I. 2002. Polar bears and seals in the eastern Beaufort Sea and Amundsen Gulf:
1891 A synthesis of population trends and ecological relationships over three decades.
1892 *Arctic* 55(1): 59-76
- 1893 Stirling, I. and C.L. Parkinson. 2006. Possible effects of climate warming on selected
1894 populations of polar bears (*Ursus maritimus*) in the Canadian Arctic. *Arctic*
1895 59(3): 261-275.
- 1896 Stirling, I. 2011. *Polar Bears: The Natural History of a Threatened Species*. Markham,
1897 Ont.; Brighton, Mass.: Fitzhenry & Whiteside.
- 1898 Stirling, I. and Derocher, A.E. 2012. Effects of climate warming on polar bears: a review
1899 of the evidence. *Global Change Biology* 18: 2694–2706.
- 1900 Stirling, I. and N.A. Øritsland. 1995. Relationships between estimates of ringed seal
1901 (*Phoca hispida*) and polar bear (*Ursus maritimus*) populations in the Canadian Arctic.
1902 *Canadian Journal of Fisheries and Aquatic Sciences* 52:2594-2612.

- 1903 Taylor, M.K., S. Akeagok, D. Andrlashek, W. Barbour, E.W. Born, W. Calvert,
1904 H.D. Cluff, S. Ferguson, J. Laake, A. Rosing-Asvid, I. Stirling and F. Messier. 2001.
1905 Delineating Canadian and Greenland polar bear (*Ursus maritimus*) populations by
1906 cluster analysis of movements. Canadian Journal of Zoology 79(4): 690-709.
- 1907 Tetlich, R., M. Andre, A.M. MacLeod, A.B. Gordon, C.A. Gruben, M. Sharpe,
1908 B. Greenland, M. Allen and E. Pascal. 2004. Arctic borderland ecological knowledge
1909 co-op community reports, 2003-04. Arctic Borderlands Ecological Knowledge Society,
1910 Whitehorse, Yukon Territory, Canada.
- 1911 Thiemman, G.W., S.J. Iverson and Stirling, I. 2008. Polar Bear Diets and Arctic Marine
1912 Food Webs: Insights from Fatty Acid Analysis. Ecological Monographs 78(4): 591-613.
- 1913 Toth, K. 2019. Polar bears in North are getting into more garbage: Research shows
1914 plastic in some bears appears to correlate with aggressive behaviour. CBC News.
1915 <https://www.cbc.ca/news/canada/north/plastics-in-polar-bear-stomachs-1.5089982>.
1916 Accessed 13 February 2020.
- 1917 Towns, L., A.E. Derocher, I. Stirling, N.J. Lunn and D. Hedman. 2009. Spatial and
1918 temporal patterns of problem polar bears in Churchill, Manitoba. Polar Biology
1919 32(10): 1529-1537.
- 1920 Transport Canada. 2017. Canada Shipping Act (CSA) 2001. Transport Canada.
1921 <https://www.tc.gc.ca/eng/marinesafety/debs-arctic-acts-regulations-csa-1782.htm>.
1922 Accessed 07 February 2020.
- 1923 Transport Canada. 2018a. Potential legislative amendments to strengthen marine
1924 environmental protection and response. Transport Canada.
1925 [https://www.tc.gc.ca/eng/potential-legislative-amendments-strengthen-marine-](https://www.tc.gc.ca/eng/potential-legislative-amendments-strengthen-marine-environmental-protection-response.html)
1926 [environmental-protection-response.html](https://www.tc.gc.ca/eng/potential-legislative-amendments-strengthen-marine-environmental-protection-response.html). Accessed 07 February 2020.
- 1927 Transport Canada. 2018b. Oceans Protection Plan – Funding graphic. Transport
1928 Canada. [https://tc.canada.ca/en/initiatives/oceans-protection-plan/infographic-15-billion-](https://tc.canada.ca/en/initiatives/oceans-protection-plan/infographic-15-billion-national-oceans-protection-plan)
1929 [national-oceans-protection-plan](https://tc.canada.ca/en/initiatives/oceans-protection-plan/infographic-15-billion-national-oceans-protection-plan) . Accessed 17 April 2025.
- 1930 Transport Canada. 2025. Implementation of the International Maritime Organization's
1931 (IMO) Prohibition on the use and carriage for use as fuel of heavy fuel oil (HFO) by
1932 ships in Canadian Arctic waters - SSB No.: 17/2024. [https://tc.canada.ca/en/marine-](https://tc.canada.ca/en/marine-transportation/marine-safety/ship-safety-bulletins/implementation-international-maritime-organization-s-imo-prohibition-use-carriage-use-fuel-heavy-fuel-oil-hfo-ships-canadian-arctic-waters-ssb-no-17-2024)
1933 [transportation/marine-safety/ship-safety-bulletins/implementation-international-maritime-](https://tc.canada.ca/en/marine-transportation/marine-safety/ship-safety-bulletins/implementation-international-maritime-organization-s-imo-prohibition-use-carriage-use-fuel-heavy-fuel-oil-hfo-ships-canadian-arctic-waters-ssb-no-17-2024)
1934 [organization-s-imo-prohibition-use-carriage-use-fuel-heavy-fuel-oil-hfo-ships-canadian-](https://tc.canada.ca/en/marine-transportation/marine-safety/ship-safety-bulletins/implementation-international-maritime-organization-s-imo-prohibition-use-carriage-use-fuel-heavy-fuel-oil-hfo-ships-canadian-arctic-waters-ssb-no-17-2024)
1935 [arctic-waters-ssb-no-17-2024](https://tc.canada.ca/en/marine-transportation/marine-safety/ship-safety-bulletins/implementation-international-maritime-organization-s-imo-prohibition-use-carriage-use-fuel-heavy-fuel-oil-hfo-ships-canadian-arctic-waters-ssb-no-17-2024). Accessed April 16 2025.
- 1936 Tynan, C.T. and D.P. DeMaster. 1997. Observations and predictions of Arctic climatic
1937 change: Potential effects on marine mammals. Arctic 50(4): 308-322.

- 1938 Vongraven, D. and Richardson, E. 2011. Biodiversity – Status and Trends of Polar
1939 Bears.
1940 https://www.researchgate.net/profile/Dag_Vongraven/publication/236667989_Status_and_trends_of_polar_bears/links/0c960518cb520018900000000.pdf. Accessed
1941
1942 07 February 2020.
- 1943 Watts, P.D. and S.E. Hansen. 1987. Cyclic starvation as a reproductive strategy in the
1944 polar bear. *Symposia of the Zoological Society of London* 57: 305-318.
- 1945 Weber, D.S., P.J. Van Coeverden De Groot, E. Peacock, M.D. Schrenzel, D.A. Perez,
1946 S. Thomas, J.M. Shelton, C.K. Else, L.L. Darby, L. Acosta, C. Harris, J. Youngblood,
1947 P. Boag and R. Desalle. 2013. Low MHC variation in the polar bear: implications in the
1948 face of Arctic warming? *Animal Conservation* 16(6): 671-683.
- 1949 Wenzel, G.W. 2011. Polar bear management, sport hunting and Inuit subsistence at
1950 Clyde River, Nunavut. *Marine Policy* 35(4): 457-465.
- 1951 Wiig, Ø., S. Amstrup, T. Atwood, K. Laidre, N. Lunn, M. Obbard, E. Regehr and
1952 G. Thiemann. 2015. The IUCN Red List of Threatened Species 2015: *Ursus maritimus*.
1953 IUCN. <https://www.iucnredlist.org/species/22823/14871490>. Accessed on 07 February
1954 2020.
- 1955 York, J, A. Dale, J. Mitchell, T. Nash, J. Snook, L. Felt, *et al.* 2015. Labrador polar bear
1956 traditional ecological knowledge final report. Torngat Wildlife Plants and Fisheries
1957 Secretariat Ser. 2015/03, iv + 118 pp.

**Part 2 – *Inuvialuit Settlement Region Polar Bear Joint
Management Plan*, prepared by the Joint Secretariat
Inuvialuit Settlement Region**

Inuvialuit Settlement Region Polar Bear Joint Management Plan 2017



As recommended by:



to:

**Minister of Environment and Climate Change, Canada
Minister of Environment and Natural Resources,
Government of Northwest Territories
Minister of Environment, Government of Yukon**

Recommended citation:

Joint Secretariat. 2017. Inuvialuit Settlement Region Polar Bear Joint Management Plan. Joint Secretariat, Inuvialuit Settlement Region. vii + 66 pp.

© 2017 Joint Secretariat, Inuvik, NWT
All rights reserved.

ISBN: 978-0-7708-0251-6

Cover photo: Jodie Pongracz, University of Alberta

PREFACE

The *Inuvialuit Settlement Region Polar Bear Joint Management Plan* is intended to describe the management goal and objectives for polar bears in the entire Inuvialuit Settlement Region (ISR), including the Northwest Territories (NWT) and Yukon. This plan was developed to meet the requirements of a management plan under the territorial *Species at Risk (NWT) Act* and the ISR (Yukon and NWT) regional component of the national management plan under the federal *Species at Risk Act* while respecting the joint management process legislated by the Inuvialuit Final Agreement (IFA).

Management authority for polar bears in the ISR is jurisdictionally complex and the plan is intended to facilitate an integrated and common approach by all jurisdictions. To facilitate this process, a companion document, *Framework for Action for Management of Polar Bears in the Inuvialuit Settlement Region* has been developed. This document outlines actions and areas where further work should be directed. The framework is meant to be used by management partners to develop an implementation table.

Implementation of this joint management plan and companion document is subject to budgetary appropriations, priorities, and constraints of the participating management organizations.

The following groups approved this *ISR Polar Bear Joint Management Plan* and the accompanying *Framework for Action for Management of Polar Bears in the Inuvialuit Settlement Region*, on the date listed:

Wildlife Management Advisory Council (NWT): December 11, 2016

Wildlife Management Advisory Council (North Slope): December 6, 2016.

Inuvialuit Game Council: December 16, 2016

On January 25, 2017 these groups then recommended the adoption of these two documents to the federal Minister of Environment and Climate Change; the Minister of Environment and Natural Resources, Government of the Northwest Territories; and the Minister of Environment, Government of Yukon.

The Wildlife Management Advisory Council (NWT) and the Government of the Northwest Territories adopted this *ISR Polar Bear Joint Management Plan* and the accompanying *Framework for Action for Management of Polar Bears in the Inuvialuit Settlement Region* through a Conference of Management Authorities consensus agreement on March 27, 2017, to fulfill the requirement for a polar bear management plan under the *Species at Risk (NWT) Act*.

ACKNOWLEDGMENTS

Preparation of this document was funded by GNWT Environment and Natural Resources (ENR), IFA Implementation funds and Species at Risk program funds. The principal compilers of this document were Marsha Branigan, Jodie Pongracz, Joanna Wilson and Lisa Worthington, ENR. Working group members included Larry Carpenter, WMAC (NWT); Jennifer Lam and Steve Baryluk, IGC; Jennifer Smith and Lindsay Staples, WMAC (NS); Todd Powell, Tom Jung, and Christine Cleghorn, YG; Peter Hale, ECCC; and Peter Sinkins, Nelson Perry and Christopher Hunter, Parks Canada.

The following organizations provided comments that significantly improved the joint management plan:

Hunters and Trappers Committees of Aklavik, Inuvik, Paulatuk, Sachs Harbour, Tuktoyaktuk, and Ulukhaktok

Wildlife Management Advisory Council (NWT)

Wildlife Management Advisory Council (North Slope)

Inuvialuit Game Council

Government of the Northwest Territories

Yukon Government

Environment and Climate Change Canada

Parks Canada

GLOSSARY OF TERMS

Adaptive management: an approach to environmental management that continually seeks the best way to reach management objectives. This is done through predicting outcomes of potential decisions, monitoring to understand the impacts of actions, and the use of all available information to adjust management objectives as necessary. Adaptive management incorporates learning and collaboration among scientists, managers and other stakeholders. (Source of definition: Polar Bear Range States 2015)

Development: means (a) any commercial or industrial undertaking or venture, including support and transportation facilities related to the extraction of non-renewable resources from the Beaufort Sea, other than commercial wildlife harvesting; or (b) any government project, undertaking or construction whether federal, territorial, provincial, municipal, local or by any Crown agency or corporation, except government projects within the limits of Inuvialuit communities not directly affecting wildlife resources outside those limits and except government wildlife enhancement projects. (Source of definition: Inuvialuit Final Agreement, 1984)

Exclusive right to harvest means the sole right to harvest the wildlife referred to in paragraphs 12(24)(b) and (c) and 14(6)(b) to (d), to be allocated the Total Allowable Harvest and to permit non-Inuvialuit to harvest any such wildlife. (Source of definition: Inuvialuit Final Agreement, 1984).

Invasive techniques: methods of scientific research that entail disturbing polar bears; for example, tranquilizing, handling, tagging and collaring them (Source of definition: SARC 2012; Joint Secretariat 2015).

Preferential right to harvest, with respect to the Inuvialuit, includes the right to harvest wildlife for subsistence usage and to be allocated, subject to conservation, quantities of wildlife sufficient to fulfil Inuvialuit requirements for subsistence usage before there is any allocation for other purposes in areas where the Inuvialuit will have harvesting rights. (Source of definition: Inuvialuit Final Agreement 1984).

Quota: number of animals from the Total Allowable Harvest that a particular group of hunters (e.g. Inuvialuit/non-Inuvialuit, or different communities) can take for a particular purpose (subsistence, recreational, sport and commercial uses). (Source of definition: WMAC (NS) 2008). The Inuvialuit Final Agreement sections 12(41) and 14 (36) describe how the quotas are established within the Total Allowable Harvest and how they are allocated.

Total Allowable Harvest (TAH): a limit put on the number of wildlife that may be harvested in a year. If a Total Allowable Harvest has been established for a wildlife population, a quota will be used to distribute the total number of animals that can be harvested. (Source of definition: WMAC (NS) 2008). The Inuvialuit Final Agreement sections 12(41) and 14 (36) describe how the TAH is determined for polar bear. Within their respective jurisdictions, governments shall determine the harvestable quotas for wildlife species based on the principles of conservation and the following procedures: (a) the WMAC (NS) and WMAC (NWT) shall determine the Total Allowable Harvest for game according to conservation criteria and such other factors as it considers appropriate. Each Council shall make its recommendations to the appropriate Minister,

who shall, if he differs in opinion with the Council, set forth to the Council his reasons and afford the Council a further consideration of the matter; (b) in determining the Total Allowable Harvest, conservation shall be the only consideration. For greater certainty, where the Inuvialuit have the exclusive right to harvest, they shall be entitled to harvest the Total Allowable Harvest.

Traditional Knowledge (TK): The following explanation of TK is taken from Joint Secretariat (2015):

“The Inuvialuit people interviewed talk about their knowledge of polar bears as a form of Traditional Knowledge (TK):

[It] is a cumulative body of knowledge, know-how, practices and presentations maintained and developed by the peoples over a long period of time. This encompasses spiritual relationships, historical and present relationships with the natural environment, and the use of natural resources. It is generally expressed in oral form, and passed on from generation to generation by storytelling and practical teaching (Smith 2006: i).

TK goes by other names as well, including Inuit Qaujimagatuqangnit (IQ), Traditional Ecological Knowledge (TEK), Local Ecological Knowledge (LEK) and Aboriginal Traditional Knowledge (ATK). All of these terms are labels for practical, craft knowledge acquired through direct experience and by watching, listening to, and travelling and harvesting with more experienced people on the land, ice and water” (Joint Secretariat 2015: 3).

“The Inuit term qaujimagatuqangnit [cow-yee-ma-ya-tu-kang-eet] means “things they have known for a long time” According to Thorpe et al (2001: 4), this is “knowledge, insight, and wisdom that is gained through experience, shared through stories, and passed from one generation to the next. More than just knowledge, as commonly defined, [it]... includes a finely tuned awareness of the ever-changing relationship between Inuit and nuna (the land), hila (the weather), wildlife, and the spiritual world.” Inuit studies scholar Jean Briggs notes that the Inuit conception of “knowledge” is more complex than the Euro-North American one. “Facts by themselves do not constitute knowledge. Words you get out of a dictionary do not constitute knowledge. Stuff you learn in school is not knowledge. To know something, you have to live it, know how it behaves, how you have to treat it, how it fits into your life” (pers. comm., Peter Armitage, 17 April 2009)” (Joint Secretariat 2015: 217).

EXPLANATION OF ABBREVIATIONS

AB	Arctic Basin subpopulation
CAP	Circumpolar Action Plan for polar bears
CITES	Convention on International Trade in Endangered Species of Wild Flora and Fauna
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
DLP	Defense of life and property mortality
EIRB	Environmental Impact Review Board
EISC	Environmental Impact Screening Committee
ENR	Department of Environment and Natural Resources, GNWT
GC	Government of Canada
GNWT	Government of the Northwest Territories
HTC	Hunters and Trappers Committee
IFA	Inuvialuit Final Agreement
IGC	Inuvialuit Game Council
ISR	Inuvialuit Settlement Region
ITK	Inuit Tapiriit Kanatami
LK	Local knowledge
NB	Northern Beaufort Sea subpopulation
NWT	Northwest Territories
PBAC	Polar Bear Administrative Committee
PBHIMS	Polar Bear-Human Information Management System
PBTC	Polar Bear Technical Committee
POP	Persistent organic pollutant
SARA	<i>Species at Risk Act</i>
SARC	Northwest Territories Species at Risk Committee
SB	Southern Beaufort Sea subpopulation
TAH	Total Allowable Harvest
TK	Traditional Knowledge
US	United States
USFWS	United States Fish and Wildlife Service
VM	Viscount Melville Sound subpopulation
WMAC (NS)	Wildlife Management Advisory Council (North Slope)
WMAC (NWT)	Wildlife Management Advisory Council (Northwest Territories)
YG	Government of Yukon

EXECUTIVE SUMMARY

Polar bears in Canada were assessed by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) in 2008 and listed under the federal *Species at Risk Act* as a species of “special concern” in 2011. Polar bears in the NWT were assessed by the Species at Risk Committee (SARC) and listed under the *Species at Risk (NWT) Act* as a species of “special concern” in 2014. The purpose of this joint management plan is to describe and enhance the existing management system in the ISR in order to achieve the management **goal of ensuring the long-term persistence of healthy polar bears in the ISR while maintaining traditional Inuvialuit use.**

Management approaches and actions to achieve objectives are presented in this plan in Section 6. Recommended management objectives for polar bears in the ISR are:

- 1) Collect traditional knowledge, scientific knowledge and monitoring information in a timely manner to inform management decisions
- 2) Adaptively co-manage polar bears and their habitat in accordance with the best information available
- 3) Encourage wise use of polar bear populations and all polar bear products
- 4) Minimize detrimental effects of human activities on polar bears and their habitat
- 5) Communicate and share information on polar bears and impacts of climate change on polar bears

Pivotal to success, the ISR operates under a structured joint management system that uses adaptive management, a legislated harvest management system with conservation as the overriding management principle, and has the intent to communicate, collaborate, and coordinate to achieve objectives. Under the Inuvialuit Final Agreement, both science and Inuvialuit traditional knowledge (TK) and local knowledge (LK) are considered when making management decisions.

Objectives and associated management approaches to achieve the management goal were developed with input from all management partners in the ISR, and the companion document, *Framework for Action, a companion document to the ISR Polar Bear Joint Management Plan* was developed at the same time to facilitate implementation of the plan. The companion document outlines actions and areas where further work should be directed. The framework is meant to be used by management partners to develop an implementation table (to be completed following approval of this management plan).

The management agencies in the ISR will report on implementation of the plan after five years. A joint management plan will remain in effect for as long as polar bears are listed as a species at risk under the *Species at Risk (NWT) Act* or the federal *Species at Risk Act*. The plan will be reviewed and updated in 10 years or at the request of an organization with management authority for polar bears in the ISR.

CONTENTS

PREFACE	i
ACKNOWLEDGMENTS	ii
GLOSSARY OF TERMS	iii
EXPLANATION OF ABBREVIATIONS:	v
EXECUTIVE SUMMARY	vi
1. MANAGEMENT PLANNING	1
1.1 Purpose of the Plan.....	1
1.2 Management Goal	1
1.3 Management Objectives	1
1.4 Management planning process	2
2. JOINT MANAGEMENT.....	2
2.1 Legislative framework and agreements.....	2
2.2 Polar Bear joint management in the Inuvialuit Settlement Region.....	4
2.2.1 Wildlife Management Advisory Councils.....	6
2.2.2 Inuvialuit Game Council	6
2.2.3 Inuvialuit Hunters and Trappers Committees.....	6
2.2.4 Environmental Impact Screening Committee.....	6
2.2.5 Environmental Impact Review Board	7
2.2.6 Government of Northwest Territories	7
2.2.7 Government of Yukon	7
2.2.8 Government of Canada.....	7
2.2.9 Collaboration/Coordination	8
3. SOCIAL PERSPECTIVES	8
4. SPECIES INFORMATION	10
4.1 Species Status.....	10
4.2 Species Description	11
4.3 Population and Distribution	11
4.4 Habitat and biological needs	13
4.5 Limiting Factors	14
4.6 Threats.....	14
4.7 Positive influences.....	22
4.8 Knowledge Gaps	22
5. CURRENT HARVEST MANAGEMENT SYSTEM.....	23
6. MANAGEMENT ACTIONS AND APPROACHES TO ACHIEVE OBJECTIVES	24
7. MEASURING PROGRESS.....	31
8. NEXT STEPS	38
REFERENCES	39
Appendix A: Additional Traditional Knowledge about ISR Polar Bear	46
Appendix B: Background Information on Subpopulation Status Assessments and History of Harvest Management.....	48
Appendix C: Threats Classification Table by Polar Bear Subpopulation.....	58

1. MANAGEMENT PLANNING

1.1 Purpose of the Plan

The listing of polar bear as a species of special concern under the federal *Species at Risk Act* (2011) and the Northwest Territories' *Species at Risk (NWT) Act* (2014) triggered the need for management plans under both legislative processes.

To ensure coordinated and consistent planning across the Inuvialuit Settlement Region (ISR) (NWT and Yukon portions), and to avoid duplication of effort, the Wildlife Management Advisory Council (Northwest Territories) (WMAC (NWT)) and Wildlife Management Advisory Council (North Slope) (WMAC (NS)) have developed this joint plan. The joint management plan for polar bears in the ISR is intended to meet the requirements under both NWT and federal legislation for species at risk. No equivalent legislative requirements exist in Yukon. This plan outlines specific regional approaches and serves as the ISR component of the overarching 'umbrella' management plan for Canada.

The well-developed and effective polar bear joint management regime in place in the ISR today was established pursuant to the 1984 Inuvialuit Final Agreement, Yukon and NWT *Wildlife Acts*, *Canada National Parks Act*, *Species at Risk (NWT) Act*, and federal *SARA*. This joint management plan facilitates coordination and cooperation amongst management partners based on the shared goal, objectives and approaches that it establishes for polar bear management in the ISR. This plan will assist management partners in planning and prioritizing their work in order to manage human impacts on polar bears in the ISR.

1.2 Management Goal

The overall management goal is:

To ensure the long-term persistence of healthy polar bears in the ISR while maintaining traditional Inuvialuit use.

1.3 Management Objectives

Although climate change is the most important threat facing polar bears and their habitat, and action to reduce greenhouse gas emissions is required for the long-term conservation of polar bears, addressing climate change is beyond the scope of an ISR polar bear joint management plan. Alternatively, actions will be taken to ensure that the impact of climate change on polar bears is highlighted through the appropriate regional, national and international fora, and that effects of climate change on polar bears are monitored and mitigation actions taken where possible.

This joint management plan recommends the following objectives for the management of the polar bear in the ISR:

Objective 1: Collect traditional knowledge, scientific knowledge and monitoring information in a timely manner to inform management decisions.

Objective 2: Adaptively co-manage polar bears and their habitat in accordance with the best information available

Objective 3: Encourage wise use of polar bear populations and all polar bear products

Objective 4: Minimize detrimental effects of human activities on polar bears and their habitat

Objective 5: Communicate and share information on polar bears and impacts of climate change on polar bears

1.4 Management planning process

This joint management plan was prepared by ENR (GNWT), in collaboration with other planning partners. To facilitate plan development, the WMAC (NWT) held public meetings with the Hunters and Trappers Committees (HTCs) in all 6 ISR communities in 2013, 2014, and 2016 to discuss the potential listing of polar bears, the draft management framework, and the draft plan, respectively. The six communities are Aklavik, Inuvik, Tuktoyaktuk, Paulatuk, Sachs Harbour and Ulukhaktok.

As part of the engagement and consultation process, there were numerous discussions with representatives of Environment and Natural Resources (ENR), WMAC (NWT), WMAC (NS), Inuvialuit Game Council (IGC), Environment Yukon, Parks Canada, and Environment and Climate Change Canada to gather feedback and direction.

ENR also consulted on the draft management framework with relevant Aboriginal organizations including the IGC, Inuvialuit Regional Corporation, and Nunavut Tunngavik Incorporated with respect to potential infringement of established or asserted Aboriginal or treaty rights.

Input was also requested from Department of Fisheries and Oceans, North Slope Borough, US Fish and Wildlife Service, Government of Nunavut, and ISR Fisheries Joint Management Committee. Input from all parties, including the general public, was solicited through the posting of the draft plan on the NWT species at risk website for public comment. Feedback received during engagement and consultation was considered when drafting the final plan.

To facilitate implementation of this plan the companion document, *Framework for Action, a companion document to the ISR Polar Bear Joint Management Plan* was developed at the same time. The framework outlines actions and areas where further work should be directed. The framework is meant to be used by joint management partners to develop an implementation table.

2. JOINT MANAGEMENT

2.1 Legislative framework and agreements

The comprehensive land claim affecting the Western Arctic Region of the Northwest Territories and the North Slope of Yukon was settled in 1984. The land claim agreement was passed into federal law and is known as the Inuvialuit Final Agreement (IFA). In the Inuvialuit Settlement

Region (ISR) of the NWT and Yukon, wildlife is managed in accordance with sections 12, 13, and 14 of the IFA. These sections define the principles of wildlife harvesting and management, identify harvesting rights, and explain the joint management process and conservation principles. They define the structure, roles, and responsibilities of the Wildlife Management Advisory Councils (WMACs) for the North Slope (NS) and Northwest Territories (NWT), governments, the Inuvialuit Game Council (IGC), the Inuvialuit Hunters and Trappers Committees (HTCs), the Environmental Impact Screening Committee (EISC) and the Environmental Impact Review Board (EIRB).

All polar bear subpopulations in the ISR are shared with other jurisdictions; therefore, it is imperative that management actions are coordinated with applicable jurisdictions. Polar bear subpopulations shared with Alaska (Southern Beaufort Sea) and Nunavut (Northern Beaufort Sea and Viscount Melville Sound) have user-to-user agreements. The *Inuvialuit-Inupiat Polar Bear Management Agreement in the Southern Beaufort Sea* was established in 1988 (last revised in 2011); and the *Polar Bear Management Agreement for the North Beaufort Sea and Viscount-Melville Sound Polar Bear Populations between the Inuit of the Kitikmeot West Region in Nunavut and the Inuvialuit* was established in 2006. These agreements facilitate coordinated management of polar bears including managing polar bear harvest on a sustainable yield basis, protecting bears in dens and family groups, and encouraging that the female proportion of the harvest does not exceed one-third of the total harvest. There is also a *2008 Memorandum of Understanding between Environment Canada and the United States Department of the Interior for the Conservation and Management of Shared Polar Bear Populations*.

The NWT and Yukon *Wildlife Acts* and associated regulations enable polar bear harvest management provisions to be enforceable in the ISR. The HTC by-law regulations under the NWT *Wildlife Act* identify requirements for use of tags, harvest reporting, and sample submission. The Yukon *Wildlife Act* has a similar ability to establish HTC by-laws. The *Canada National Parks Act* applies in National Parks in the ISR.

In 1973, Canada was a signatory to the international *Agreement on the Conservation of Polar Bears*, and Canada's *Letter of Interpretation* upon ratification of the *Agreement*. This agreement requires Canada to "take appropriate action to protect the ecosystems of which polar bears are a part, with special attention to habitat components such as denning and feeding sites and migration patterns, and shall manage polar bear populations in accordance with sound conservation practices based on the best available scientific data". The range states have agreed to also consider TK and LK in conservation and management and in 2015, the range states developed the Circumpolar Action Plan (CAP) for polar bears. Recognizing that management systems are already in place in each range state, the CAP focuses on issues that are best coordinated at the international level.

In 2011 polar bears were listed under the federal *Species at Risk Act (SARA)* as a species of special concern. In 2014 polar bears were listed with the same designation under the *Species at Risk (NWT) Act*.

Polar bears are listed under Appendix II of the *Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES)*. This means that any international shipment of polar

bears or parts thereof requires a permit, and the export must be shown to be non-detrimental to the survival of polar bears.

Potential impacts of development on polar bears and their habitat are managed through the regulatory system. All developments in the ISR must satisfy the screening and environmental assessment requirements of the IFA, the *Yukon Environmental and Socioeconomic Assessment Act*, and the *Canadian Environmental Assessment Act, 2012*.

2.2 Polar Bear joint management in the Inuvialuit Settlement Region

Inuvialuit have exclusive rights to harvest polar bears in the ISR. In implementing the IFA, the Inuvialuit and the governments of Canada, the Northwest Territories and Yukon share management responsibilities in the Inuvialuit Settlement Region for renewable resources, including polar bears. Figure 1 illustrates the joint management system in the ISR as it applies to polar bears. Government and Inuvialuit interests are equally represented on joint management bodies established as a result of the IFA. The management bodies responsible for polar bears are illustrated in Figure 1 and listed below in detail.

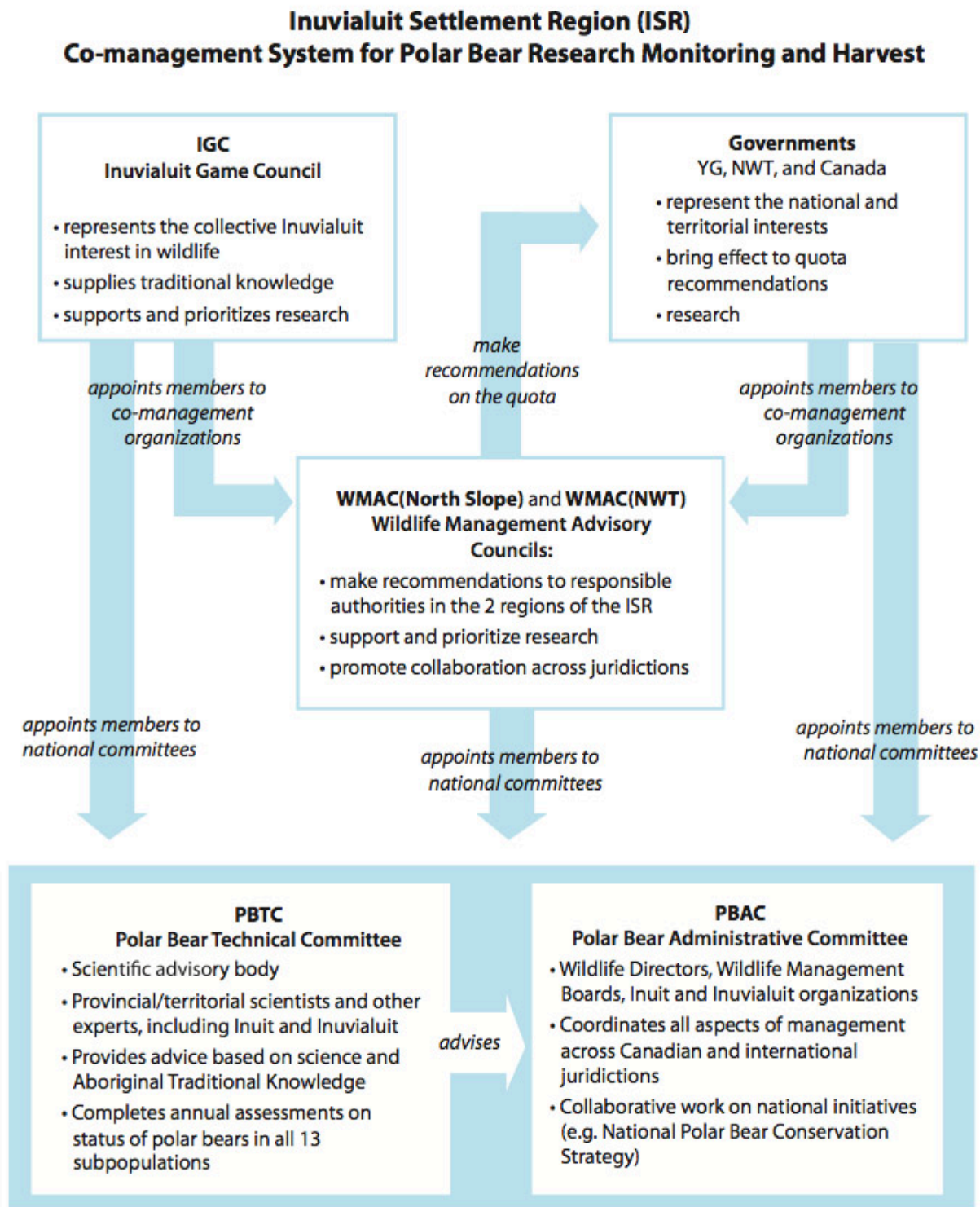


Figure 1. Illustration of joint management processes for polar bear research, monitoring and harvest in the ISR

2.2.1 Wildlife Management Advisory Councils

The WMAC (NWT) and WMAC (NS) are the main instruments of wildlife management in the Western Arctic Region of the NWT and the Yukon North Slope respectively. The WMAC (NWT) and the WMAC (NS) advise the federal and territorial governments on wildlife policy, management, regulation, and administration of wildlife, habitat and harvesting in the Inuvialuit Settlement Region (*Inuvialuit Final Agreement*, sections 14 and 12 respectively). The recommendations of these joint management groups provide the foundation for polar bear management in the ISR. These recommendations are based on best available information including TK, LK and science. The WMACs work collaboratively with the IGC, HTC, and governments in research, monitoring and management of polar bears and their habitat. The WMACs consult regularly with IGC and HTCs, and these groups assist the WMACs in carrying out their functions. The WMACs recommend appropriate quotas for Inuvialuit wildlife harvesting, including Total Allowable Harvest for polar bears. They also provide comments during environmental screening and review processes regarding the monitoring and mitigation of impacts of development on polar bears and their habitat.

2.2.2 Inuvialuit Game Council

The Inuvialuit Game Council (IGC) represents the collective Inuvialuit interest in wildlife and wildlife habitat matters. The IGC appoints members for all joint government/Inuvialuit bodies having an interest in wildlife in the ISR, reviews and advises the government on any proposed Canadian position for international purposes that affects wildlife in the ISR, appoints members whenever possible or appropriate for any Canadian delegation that deals with international matters affecting wildlife harvesting by the Inuvialuit, allocates wildlife quotas among the communities, and assigns community hunting and trapping areas.

2.2.3 Inuvialuit Hunters and Trappers Committees

The local Hunters and Trappers Committees (HTCs) advise the IGC, and WMACs on local wildlife matters, sub-allocate subsistence quotas and other regulated harvesting (tagged species) within the community, and make by-laws governing the exercise of Inuvialuit exclusive and preferential harvesting rights that are made enforceable under territorial and federal legislation. The HTCs work with other organizations in each community to develop Community Conservation Plans, which provide guidance on the conservation and management of natural resources and lands within the ISR.

2.2.4 Environmental Impact Screening Committee

The EISC, together with the EIRB, plays an important role in regulating potential impacts of development on polar bears and their habitat. In accordance with the IFA, any development is subject to review before projects can be approved and permits issued. The EISC conducts environmental screening of development activities proposed for both the onshore and offshore areas of the ISR. The EISC determines if proposed developments could have a significant negative environmental impact on wildlife (including polar bears), wildlife habitat, and on wildlife harvesting. Where the EISC determines that the proposed development could have a significant negative environmental impact, it will be referred and subject to assessment and review by the EIRB.

2.2.5 Environmental Impact Review Board

The EIRB carries out detailed environmental impact assessments and public reviews of development projects referred to it by the EISC. The EIRB determines whether a project should proceed and, if so, under what specific terms and conditions, and the EIRB makes recommendations to the appropriate federal and territorial ministers.

2.2.6 Government of Northwest Territories

The Government of the Northwest Territories (GNWT), represented by the Minister of Environment and Natural Resources (ENR), has ultimate responsibility for the conservation and management of polar bears and their habitat in the NWT, in accordance with the Inuvialuit Final Agreement. ENR takes a lead role in polar bear monitoring and in coordinating and enforcing harvest management outlined in the HTC by-laws that are written into regulation under the NWT *Wildlife Act*. It is the Minister of ENR's ultimate responsibility to prepare and complete a management plan for polar bears under the *Species at Risk (NWT) Act*. However, decisions on polar bear listing and management plans under the Act are made jointly with the Wildlife Management Advisory Council (NWT) through the NWT Conference of Management Authorities process (www.nwt-speciesatrisk.ca).

2.2.7 Government of Yukon

The Government of Yukon, represented by the Minister of Environment, is responsible for the conservation and management of Yukon's polar bears, in accordance with relevant legislation and agreements. Environment Yukon takes the lead role in ensuring management and protection of polar bears and their habitat, and coordinating harvest management within Yukon. Environment Yukon actively engages in multi-jurisdictional species at risk recovery planning efforts to ensure sound management and recovery principles are developed that can be applied within Yukon.

2.2.8 Government of Canada

Under the federal *Species at Risk Act* (SARA), Environment and Climate Change Canada is responsible for completing a national management plan for polar bears. The Government of Canada (GC) is responsible for managing polar bears and their habitat on federal lands under the jurisdiction of the federal Minister of Environment and Climate Change (e.g., National Wildlife Areas and Migratory Bird Sanctuaries) and Minister responsible for the Parks Canada Agency (National Parks, National Park Reserves and National Historic Sites). The GC contributes to scientific knowledge of polar bears through research and helps to coordinate polar bear management efforts across the country. The GC signs international agreements on behalf of all jurisdictions and has responsibilities to coordinate international management actions for polar bears, with the advice of the joint management boards and jurisdictions. It is therefore involved in international polar bear management forums including the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) and the development of the Circumpolar Action Plan for polar bears through the range states under the 1973 international Agreement (Polar Bear Range States 2015).

2.2.9 Collaboration/Coordination

Polar bear management organizations coordinate activities through the Polar Bear Administrative Committee (PBAC) and the Polar Bear Technical Committee (PBTC), which is made up of aboriginal organizations and governments that have management authority of polar bears in Canada. The PBAC receives technical advice and support from the PBTC, which is made up of technical representatives (TK and science). These committees work together to facilitate collaborative research and coordinate conservation initiatives at the national level. They provide annual assessments on the status of each of Canada's 13 polar bear subpopulations, and provide advice on matters of national concern regarding the polar bear. In an effort to foster collaboration and understanding the PBAC developed the 2011 *National Polar Bear Conservation Strategy for Canada*.

Under the auspices of the 1973 *Agreement on the Conservation of polar bears*, the range states signed the 2013 *Declaration of the Responsible Ministers of the Polar Bear Range States*, and completed a *Circumpolar Action Plan* for polar bears in 2015.

3. SOCIAL PERSPECTIVES

The history of the Inuvialuit and their ancestors in the Beaufort region and Mackenzie Delta is long and complex. It extends far back in time to the arrival of the Thule Inuit, and perhaps even to their predecessors, the Dorset people. Inuvialuit have deep roots in the territory and a resulting vast, accumulated knowledge of its geography, fauna, weather, and ice conditions. This knowledge has made it possible for Inuvialuit to find food, create clothing, and enjoy a vibrant intellectual and emotional life for generations.

Polar bears and their harvest have long been an important part of Inuvialuit culture and economy. Many Inuvialuit stories reinforce the critical importance of polar bears, ice knowledge and safety, and provide guidance in difficult situations. In the days before trade in industrially derived commodities took hold, and when Inuvialuit lived outside of settled communities, polar bear meat was a welcome addition to the family diet. This meat nourished people and their dog teams alike, especially at certain times of the year when other food was in short supply. Polar bear pelts provided clothing, mattresses, and tools. Apart from the bears' economic contribution, they also nourished the Inuvialuit imagination, due in large measure to their strength, agility, and above all, their great intelligence. Polar bears feature prominently in Inuvialuit mythology, spirituality, storytelling, art, song, and other forms of cultural expression and traditions.

The high cost of living in the western Arctic, including the price of gas, oil, and food, has deterred many younger people from harvesting polar bears to the extent that previous generations did. Despite complicated socio-economic pressures faced by Inuvialuit, contemporary polar bear hunters hope their traditions will be continued by younger people. According to one Paulatuk hunter,

"...Everybody wants to live in the modern world. But you know, there's things like polar bear hunting that is a part of our life, has been a part of our lives, and will be

part of our lives for, I'm hoping, forever and ever. Because it's a part of us, eh?"
(Joint Secretariat 2015: 202).

Polar bears remain at the pinnacle of Inuvialuit cultural significance and conservation efforts. Formal collaborations have been developed and implemented with neighbouring Inuit groups that share access and management responsibilities for the respective subpopulations. Additional traditional knowledge about ISR polar bears can be found in Appendix A.



Figure 2. An Inuvialuit hunter observes a polar bear on land. Photo R. Hamburg © GNWT.

4. SPECIES INFORMATION

4.1 Species Status

Common Names: Polar bear (English), Nanuq (Inuvialuktun), Ours blanc (French)

Scientific Name: *Ursus maritimus*

Occurrence: Polar bears are distributed throughout the circumpolar Arctic where there is annual and multi-year sea ice. In the ISR, polar bears are typically found on sea ice. Seasonally, they may be found along the coastline of the mainland and the Arctic Islands and occasionally inland.

Table 1. Summary of status designations in the ISR and Canada

Jurisdiction	Status Assessment ¹	Legal Listing ²
NWT	Special Concern (2012) ³	Special Concern (2014) ³
Yukon ⁴	N/A	N/A
Canada	Special Concern (2008) ⁵	Special Concern (2011) ⁵

¹Status assessments are independent biological assessments. Status in the NWT is assessed by SARC; status in Canada is assessed by COSEWIC.

²This is the legal status of the species on the NWT List of Species at Risk under the territorial *Species at Risk (NWT) Act* and on Schedule 1 of the federal SARA.

³Information on the *Species at Risk (NWT) Act* and the SARC assessment is available at www.nwt-speciesatrisk.ca.

⁴Currently there is no Species at Risk legislation in place in Yukon.

⁵Information on the federal *Species at Risk Act* and the COSEWIC assessment is available at www.sararegistry.gc.ca.



Figure 3. A polar bear (Nanuq). Photo J. Lee © GNWT.

4.2 Species Description

Polar bears are a long lived species that have late sexual maturation and low reproductive rates. They have morphological and physical adaptations to thrive in the Arctic environment and are dependent on the sea ice platform for various aspects of their life history including hunting, movement, mating, and denning. Polar bears are at the top of the Arctic food chain with their primary prey being ringed seals and, to a lesser extent, bearded seals.

4.3 Population and Distribution

Within the ISR polar bears inhabit areas with sea ice and adjacent coastal areas in certain seasons (Figure 4). Their location is typically dependent on sea ice conditions and availability of prey. Polar bears cover large ranges and are constantly moving to find ideal ice conditions and an abundance of seals. The number of bears in each subpopulation can vary over time, and information regarding polar bear abundance and distribution is required for harvest management purposes.

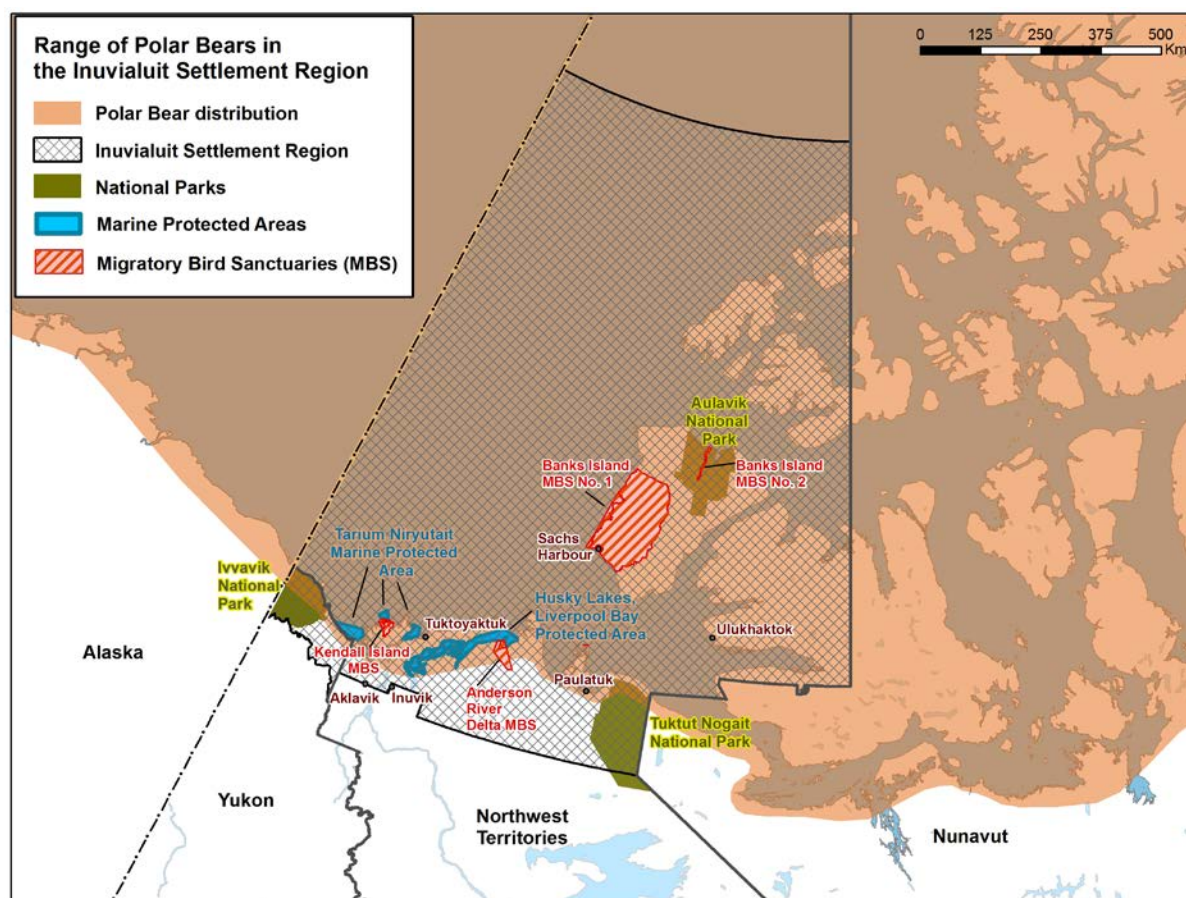


Figure 4. Range of polar bears in relation to the Inuvialuit Settlement Region.

There are four subpopulations of polar bears in the ISR: Southern Beaufort Sea (SB), Northern Beaufort Sea (NB), Viscount Melville Sound (VM), and Arctic Basin (AB) (Figure 5). These subpopulations are all shared with jurisdictions outside the ISR (Table 2). Subpopulations were delineated using information on polar bear movement patterns and genetics, as well as

consideration of management. There is frequent movement of bears between these areas, and both scientists and Inuvialuit believe these subpopulations are not isolated. Many Inuvialuit consider the SB and NB to be a single group of bears that move according to good hunting conditions, however, subpopulations are employed as units to facilitate harvest management.

The boundary between the NB and SB subpopulations was revised in 2013/14 (Figure 5) in an attempt to better reflect separation between these subpopulations based on movement analyses (Amstrup et al. 2006). The current east/west boundary is at 133°W. For this change to occur, community consultations and additional analyses (Griswold et al. unpublished paper) were undertaken to inform the final recommendations for the boundary change and subsequent quota changes. The changes were implemented commencing in the 2013/2014 hunting season.

Regionally, polar bear abundance estimates have been determined from scientific population mark-recapture studies; work is underway to refine less invasive methods (such as aerial surveys) that provide necessary information to managers, while eliminating the use of immobilization drugs and minimizing disturbance to polar bears. Techniques have also been developed for the rigorous collection of traditional knowledge information (see Armitage and Kilburn 2015), which, along with scientific information is used to inform population trend.

Table 2. Polar bear subpopulations in the ISR (adapted from 2015 PBTC Status Table). For underlying details of estimates and trend, see Appendix B and PBTC (2015).

Subpopulation	Population estimate	Estimate used for management	Recent trend	LK and/or TK assessment	Shared with
Southern Beaufort Sea	1,215 ¹	1,215	Likely decline	Stable	Alaska ⁷
Northern Beaufort Sea	1,291 ²	1,710 ⁴	Likely stable	Stable	Nunavut ⁷
Viscount Melville Sound	161 ³	215 ⁵	Likely stable	Increased	Nunavut ⁷
Arctic Basin	Unknown	N/A ⁶	Unknown	Unknown	All polar bear range states

¹Based on the Regehr et al. (2007) estimate (1,526) for the previous subpopulation area adjusted for new boundary at 133°W following 2009 analysis (Griswold et al. unpublished) (-311 bears).

²Based on Stirling et al. (2011) estimate (980) for the previous subpopulation area adjusted for the new boundary at 133°W following 2009 analysis (Griswold et al. unpublished) (+311 bears).

³Based on Taylor et al. (2002) mark-recapture estimate from 1992

⁴Though the trend is not significant, Northern Beaufort Sea population estimates appear to be increasing (1972-75: 745 (± 246, 95% CI) 1985-1987: 867 (± 141, 95% CI) and 2004-2006= 980 (± 155, 95% CI) and suggest “the possibility of some continued population growth” (Stirling et al. (2007)). Stirling et al. (2011) recognize that the 2006 estimate of 980 is likely biased low (possibly related to changes in distribution) and suggest the population estimates of 1200-1300 in 2004 and 2005 may more accurately reflect the current number of bears in the population. Stirling et al. (2011) recognize that limited sampling in the northern portion of the study area may have led to estimates that are biased low. For management purposes, the population estimate for the Northern Beaufort Sea has historically and continues to be adjusted to reflect negative bias. The current estimate used for management purposes of the new Northern Beaufort Sea management area is 1,710 (WMAC (NWT) July 2011).

⁵Based on Taylor et al. (2002) population estimate (1999) based on a population viability analysis simulating a 5 year harvest moratorium after 1992 mark-recapture estimate.

⁶There is no known harvest taking place in the Arctic Basin within the ISR.

⁷User to user agreements in place.

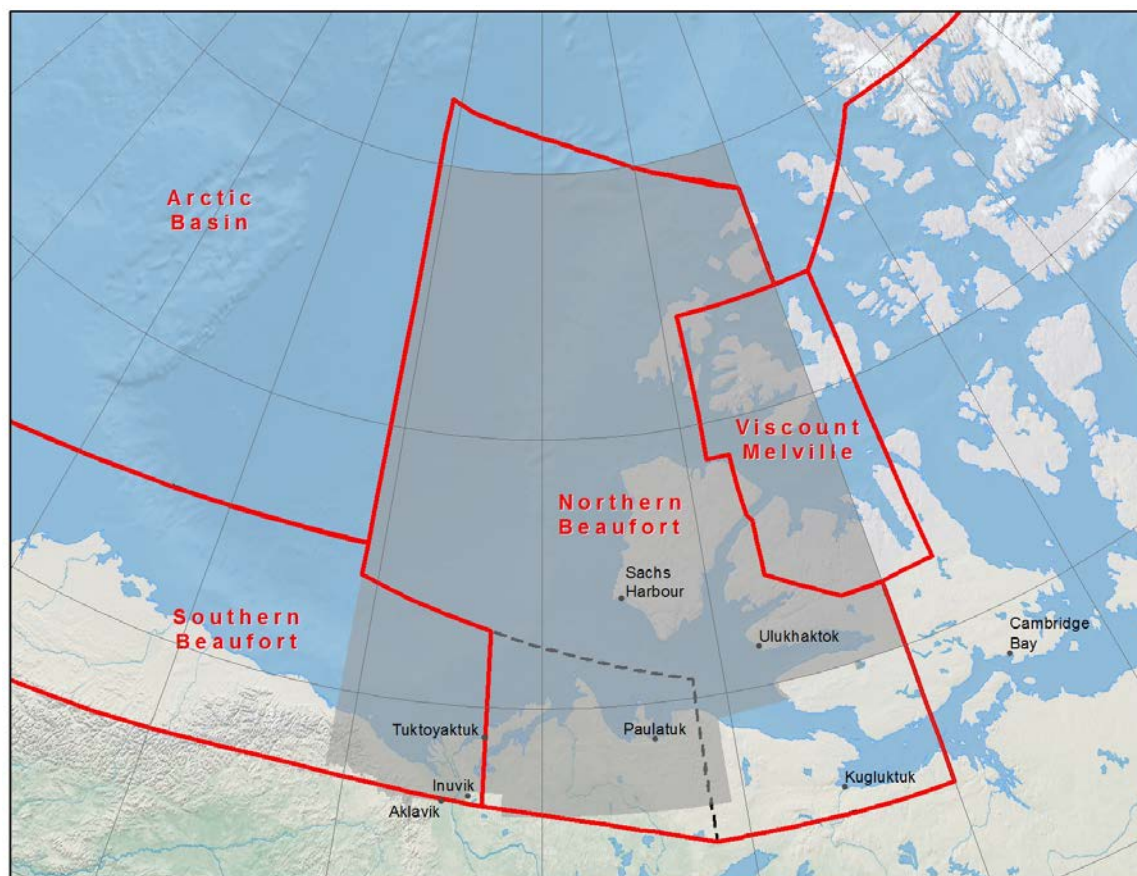


Figure 5. Subpopulation boundaries for polar bears in the ISR. New subpopulation boundaries as of 2013/2014 are shown as red lines; previous boundaries appear as dashed lines. The ISR is shown in light grey.

4.4 Habitat and biological needs

Polar bears hunt from sea ice to access their primary prey. The condition and extent of sea ice is a key factor in determining the quality of the habitat. Primary polar bear habitat in the ISR is found in productive areas with annual sea ice where seals are abundant and accessible. The sea ice is dynamic, changing in type, thickness and extent through time and space. Since sea ice is constantly changing, polar bears adapt by moving to where ice conditions are the most favourable and prey are available. A central finding in the ISR polar bear TK report is that ice conditions matter and type, thickness, and location will determine where bears are found.

Pregnant females enter maternity dens in early winter where they give birth to their cubs. They nurse their newborn cubs for three to four months before heading back out onto the sea ice. Maternity denning habitat can be found where snow accumulates on the leeward side of banks

near the coastline, in-land in ravines or depressions, and out on the sea ice. Denning female polar bears are sensitive and disturbances can lead to den abandonment and impact cub survival.

4.5 Limiting Factors

Limiting factors are characteristics of an ecosystem that act to limit the growth, abundance, or distribution of an organism. The abundance and availability of prey are important limiting factors for polar bears. These are influenced by sea ice distribution and conditions and by population cycles in ringed seals.

These factors, combined with a life history of low reproductive rates and late sexual maturity, may limit the polar bear's ability to recover from population declines.

4.6 Threats

The primary threat to polar bears is habitat change due to climate warming. *Projected warming over much of their range and the associated reductions in the extent and thickness of multi-year sea ice, and the duration and thickness of annual sea ice, will have both direct and indirect effects on polar bear. Direct effects include loss of habitat (i.e. extent and composition of sea ice), while indirect effects include ecosystem level changes on availability in prey species (such as seal), separation from terrestrial denning areas and refugia, contaminant transfer, and expansion of human activities. Climate change will be an underlying driver of many of the other threats listed below (National Conservation Strategy 2011: 4) and has potential impacts on natural survival and reproduction.*

Additional threats to polar bears in the ISR include:

- Oil and gas development – risk of large scale oil spill
- Increased shipping (could be related to oil and gas development, tourism, or an increase in shipping through the Northwest Passage)
- Human caused mortality in excess of Total Allowable Harvest (TAH)¹
- Pollution and contamination
- Research impacts
- Disease and parasites
- Competition

The threats identified are relevant to all subpopulations in the ISR; however, their impact may vary between subpopulations. Threats were classified for each subpopulation based on whether they were considered to be of concern for the sustainability of polar bear subpopulations over the life of the plan, i.e. 10 years; the results are summarized in Table 3. The threats classification is presented in detail in Appendix C. The threats classification was completed collaboratively by representatives of ENR, WMAC (NWT), WMAC (NS), IGC, Environment Yukon, Parks Canada, and Environment and Climate Change Canada in November 2015. Participants brought to the table information gathered by their respective organizations. The threats classification will be reviewed and revised as required when the management plan is reviewed, in ten years or at

¹ See glossary

the request of a management partner. Parameters used to classify the threats are listed in Appendix C.

Table 3. Overall level of concern regarding each threat to the sustainability of polar bear subpopulations, over the life of the plan, i.e. 10 years. See Appendix C for details on how the overall level of concern was determined.

Threat	Southern Beaufort	Northern Beaufort	Viscount Melville	Arctic Basin
1. Climate change (warming and ice reduction)	High/medium	Low	Low	Low
2. Oil and gas development – risk of large scale oil spill	Low	Low	Low	Low
3. Increased shipping (could be related to oil and gas development, tourism, or related to an increase in shipping through Northwest Passage)	Medium/Low	Low	Low	Low
4. Human caused mortality in excess of TAH	Low	Low	Low	Low
5. Pollution and contamination	Medium	Medium	Medium	Medium
6. Research impacts	Medium\Low	Low	Low	Low
7. Disease and parasites	Medium	Low	Low	Low
8. Competition	Low	Low	Low	Low

Each threat is described briefly below (also see Appendix C). Combinations of individual threats could result in cumulative impacts to polar bears in the ISR, especially as the habitat changes due to climate warming.

Climate Change

Traditional knowledge from the ISR indicates there have been changing sea ice and weather conditions, including a delay in freeze-up, advance in break-up, thinning of the sea ice, reduction of multiyear sea ice, shifts in wind patterns, and movement of floe edges (Joint Secretariat 2015). Traditional knowledge furthermore acknowledges that “*there is no doubt that climate change is occurring, but they [TK holders] have not yet observed changes in polar bear abundance and condition*” (Joint Secretariat 2015: 196), and most notably, “*ice conditions, the effects of climate change and polar bear behaviour are extremely complex*” (Joint Secretariat 2015: 197).

“For the Inuvialuit, the future cannot be predicted; it could be good or bad as far as polar bears are concerned. However, the consensus among the workshop participants [Inuvialuit TK holders] was that polar bears are highly intelligent animals that can adapt to climate change because they have been adapting to many things for thousands of years” (Joint Secretariat 2015: 196).

Additional traditional knowledge on polar bears and climate change can be found in Appendix A.

Western science predicts that climate change will impact most southern polar bear subpopulations first (Vongraven et al. 2012). Scientific evidence suggests the impact has already been seen on the Alaskan side of the southern Beaufort subpopulation (SB) (Rode et al. 2010). Overall the SB is likely declining (Regehr et al. 2007), a status that has been associated with changing sea ice conditions and their impact on reproduction and survival (Hunter et al. 2010, Regehr et al. 2010). Overall, polar bears in the neighbouring Chukchi Sea subpopulation appear to be responding to climate change more favourably than those of the SB (Rode et al. 2014A); and the northern Beaufort subpopulation (NB) appears to have a stable, possibly increasing population (Stirling et al. 2011).

One primary concern is the loss of annual sea ice which overlays what has been documented as preferred habitat over the continental shelf (Durner et al. 2009). The loss and alteration of habitat has both direct and indirect impacts on polar bears. Indirectly, climate change may impact the ability of polar bears to access prey (changing the distribution and characteristics of the primary platform from which they hunt). It may also lead to changes in the abundance and distribution of prey species, which may result in a shift in polar bear diets (Thiemann et al. 2008, McKinney et al. 2013). An increase in the spatial and temporal dimensions of the open water season has negative ramifications for travel between pack-ice and land, and could increase long distance swim events which come at a risk (Durner et al. 2011; Pagano et al. 2012). Changing conditions may furthermore lead to increased difficulty in accessing terrestrial denning locations (Derocher et al. 2004). A denning shift landward and eastward and a decline in the proportion of dens on sea ice has already been documented in the SB (Fischbach et al. 2007). There is also a concern that climatic conditions (wave action, erosion, and a lack of snow accumulation due to open water) may alter denning habitat (Joint Secretariat 2015) or render previously important habitats unsuitable.

Overall as sea ice extent continues to decline, bears in the Beaufort Sea who continue to retreat with pack ice may suffer nutritional consequences (Whiteman et al. 2015). It has also been predicted that as temperatures warm, bears will shift northward to common refuge areas (Derocher et al. 2004) something that may already be occurring, but not confirmed, in the ISR region.

Oil and Gas Development – Risk of large scale oil spill

While oil and gas exploration has occurred historically in the ISR, there is currently very little oil and gas exploration, partially due to uncertain economic conditions brought on by a drop in oil prices. However, significant discovery licences² exist in the both the SB and Viscount Melville Sound (VM) polar bear subpopulation areas (AANDC 2015); whereas the majority of exploration licences exist within the SB region with the exception of two blocks west of southern Banks Island (AANDC 2015; spatial data available online at <https://www.aadnc-aandc.gc.ca/eng/1100100036298/1100100036301#call>). It is possible that there may be some exploration over the life of the plan, (e.g. summer seismic programs), although progression through to production is very unlikely in the next 10 years. There are, however, four sites in production in the near shore area of Alaska (Endicott, Northstar, Oooguruk, Nukaitchuq) (<http://libertyprojectak.com/>). Mechanisms are in place to prevent oil spills, however, they can occur. As an example, hypothetical analysis suggested that the largest spill thought probable from a pipeline break of the Northstar site during September and October would potentially oil 0-27 bears and 0-74 bears respectively (Amstrup et al. 2006). Polar bears are known to be attracted to petroleum products and can be impacted through consumption of oiled prey or through self-grooming which are potentially fatal (Oritsland et al. 1981; St. Aubin 1990). The EIS for the Liberty project concluded based on project design the chance of a significant oil spill (large spill > 500 barrels) reaching the water around 1% over the life of the field (US DoI MMS 2002). Based on the above information and the low level of oil and gas exploration, during the threat assessment (Appendix C) the probability of a large scale oil spill (Tier 2 or 3 requiring national or international-level response) was judged to be low over the life of the plan, i.e. 10 years, for all sub-populations.

Increased shipping

Sea ice extent is projected to continue to decline resulting in a longer and more extensive open water season (Serreze et al. 2007, Jeffries et al. 2013) localized in the southern Beaufort Sea. This may potentially increase opportunity for shipping within the Northwest Passage. Annual commercial use of the Northwest Passage by ships with icebreaking capacity or that are escorted by icebreakers has been a reality since the 1980s. So far, this type of annual commercial use is increasing rapidly. The number of transits through the Northwest Passage increased from 4 per year in the 1980s to 20-30 per year in 2009-2013 (ENR 2015). It is important to realize that sea ice conditions are highly variable (Wilson et al. 2004). It is anticipated that the Northwest Passage will not become a viable trans-Arctic route in the foreseeable future (2020) due to several factors including variability of ice conditions, chokepoints (narrow passages through which shipping must pass), lack of adequate charts, insurance limitations, etc. (Arctic Council 2009). However, destination shipping (seasonal resupply activity, mining activity and tourism)

² SIGNIFICANT DISCOVERY LICENCE (SDL): when oil and/or gas is discovered, a company applies to the National Energy Board (NEB) for a significant discovery declaration (SDD) and to Indigenous and Northern Affairs Canada (INAC) for a significant discovery licence (SDL). However, the significant discovery licence will not be issued until the significant discovery has been declared. This licence covers the area of the discovery and provides indefinite ownership to the discovery. An SDL replaces the exploration licence but gives exactly the same rights (INAC 2007).

will continue to increase partly as a result of expanding resource development and an increase in tourism (Arctic Council 2009). Movement of liquid bulk cargo (e.g. oil) related to resource development is anticipated to be minimal as it is expected that a pipeline would remove the bulk of products from Beaufort Sea (Arctic Council 2009).

There is a lack of information regarding what potential impacts an increase in shipping would have on polar bears, however possible impacts include: 1) the alteration of habitat used by polar bears (USFWS 2015) and how this may impact behaviour and movement; 2) the potential for increased exposure to contaminants; and 3) the potential for a bear to be struck by a ship. The potential for a bear to be struck is low because although bears have been documented to make long distance swims between land and pack ice (Durner et al 2011, Pagano et al. 2012), and have been repeatedly observed in open water near the Alaskan shoreline during fall Bowhead whale surveys (Monnet and Gleason 2006), they are not aquatic or semiaquatic. It has been predicted that as shipping traffic increases the likelihood of dumping and accidents in polar bear habitat will increase (Derocher et al. 2004).

Human caused mortality in excess of TAH

Direct human-caused mortality can also limit polar bear numbers. Within the ISR, harvest is carefully managed. Human-caused mortality including hunting, defense of life and property kills, industry-related mortalities and illegal kills are tracked and counted under a quota. The human caused mortalities have been below the allowable quota for the past 20 years (ENR unpublished data). Furthermore, in recent years, changing sea ice conditions and various other factors have limited hunting in the ISR and resulted in use of only a small portion of the quota (ENR unpublished data). In Alaska, the Southern Beaufort harvest has been under an effective voluntary quota since 1988, and is currently monitored by the North Slope Borough and USFWS through a marking, tagging, and reporting program (USFWS 2010). A key aspect that ensures human caused mortality remains below TAH is a highly adaptive management system whereby information related to population abundance and trend is evaluated annually. As long as harvest management continues to be responsive to population changes, and accounts for bear-human conflicts, overhunting will be prevented.

Pollution and contamination

Polar bears are at the top of the Arctic marine food web and store energy in fats (as do their prey); as a result they are particularly vulnerable to the bioaccumulation of contaminants. Various persistent organic pollutants, heavy metals, and other emerging contaminants have been found in polar bear tissues (for summary review see AMAP 2005, AMAP 2010, AMAP 2011). Contaminant levels in polar bears for some heavy metals (mercury and cadmium) vary regionally (AMAP 2005, 2011).

The concern is that exposure to contaminants may adversely impact polar bear health. Studies have linked contaminants in polar bear tissue to altered physiological processes of the endocrine, immune and reproductive systems (for review see Sonne 2010).

Furthermore, the ingestion of anthropogenic debris by animals and birds has potential physical and physiological impacts and may cause lacerations and lesions, blockages, retention in the body for extended periods of time, or be toxic (NOAA 2014). Polar bears are exposed to marine litter and debris, from sources on land as well as garbage disposed at sea by vessels and through fishing activities. If polar bears consume refuse, they may suffer impacts internally along the digestive tract or alternatively become entangled in waste (i.e. become entangled in a fishnet (Alaska Dispatch News 2015). Polar bear TK holders speak of opening up stomachs and finding plastic. In one situation a TK holder speaks of three starving bears, one of which “*had a little piece of green plastic inside his stomach*” (Joint Secretariat 2015: 126). A second TK holder notes, “*if you open up the stomach to see what they got... I’ve seen bits of those plastic garbage bags*” (Joint Secretariat 2015: 98).

Research impacts

Inuvialuit have expressed concern over invasive research techniques including capture, immobilisation and collaring of polar bears. They believe these techniques can cause negative effects on the health and behaviour of bears.

There is concern that “*bears that have been collared for biological research are more nervous and “jumpy” which affects their ability to hunt*” (Joint Secretariat 2015: 180; also noted from 3 sources within SARC 2012). Others are concerned that satellite collars can hinder bears’ hunting efforts and possibly lead to cuts, contusions, and infections (S. Wolki in Slavik *et al.* 2009 in SARC 2012). Some harvesters have also seen wounds from tranquilizer darts become infected (G. Wolki in Slavik 2011 in SARC 2012).

Furthermore, collaring polar bears and using mark-recapture techniques are regarded as disrespectful and unethical:

“I don’t know how effective the tagging process is. Do they have to tag? I don’t know.... The way I was growing up, you don’t harass animals; you don’t. You’re there to kill it to eat.... You just don’t play with animals, no matter if you’re hunting muskrats or you’re hunting polar bear. You don’t harass animals. You don’t harass birds, anything. That’s just how we were grown up” (Joint Secretariat 2015: 279).

There have been recent scientific publications examining the impact of captures on polar bears (Rode *et al.* 2014b, Thiemann *et al.* 2013). For most bears, activity and movement rates were found to be normal within 5 days of capture (Rode *et al.* 2014b, Thiemann *et al.* 2013). Repeatedly handling bears was not found to have an impact on condition, reproduction or cub growth or survival (Rode *et al.* 2014b). Collaring was also found to have no impact on body condition, reproduction or cub survival (Rode *et al.* 2014b).

Disease and parasites

Overall polar bears are generally very healthy with few overt signs of disease. Wild polar bears have few documented diseases and parasites. Antibodies from *Toxoplasma gondii* (Jensen *et al.* 2010, Elmore *et al.* 2012), canine adenovirus and morbilliviruses (Philippa *et al.* 2004, Kirk *et al.*

2010), and *Brucella* (Rah et al. 2005, O'Hara et al. 2010) have been found. Bears have also been documented to have *Trichinella* sp. (Rodgers and Rodgers 1977, Forbes 2000), and there has been one documented case of rabies in polar bear (Taylor et al. 1991). Overall, a literature review of infectious agents identified in wild polar bears had little to no information on associated health effects (Farge et al. 2015). Alopecia has also been observed in polar bears with prevalence that varied through time (peaks in 1999 and 2012); the underlying cause for alopecia remains unknown despite examination of infected tissues (Atwood et al. 2015).

There is a concern that an increase in temperatures may speed the development of bacteria and parasites, as well as permit/increase survival in species limited by temperature (Bradley et al. 2005). An increase in temperatures may also facilitate range expansion in which 'new' Arctic species (i.e. ticks, mosquitos, grizzly bears) may bring pathogens to the arctic that were not previously present or prevalent (Bradley et al. 2005).

Traditional knowledge holders have knowledge of sickness in bears. An Ulukhaktok hunter was told by his elders never to eat polar bears whose meat and fat is yellow in colour:

"Only way we could find out that bear is sick is after we skin it. See if it's got yellow marks or big boils anywhere in the body. If you see that, the elders told me, "Don't even take the bear meat out of it. Leave it. Just take the skin." And I believe that. Because if you ever eat that bear meat, you'll probably die. Elders are right. They know. I know they're right because they're born with it... Yellow meat and fat, right through the meat. Yellow — don't eat it... In my language, they probably say ayuaktuk [abscess]. It means "sick bear."" (Joint Secretariat 2015: 126).

Additional TK holders spoke of elders warning not to touch polar bears that had died for no apparent reason: *"But I didn't touch them, because my grandfather had talked to me about [how] I shouldn't touch them because they are sick; they have sickness in them. The foxes have been eating them, and they spoil them..."* (Joint Secretariat 2015: 156) and *"But the animals that die by themselves, we're not allowed to touch them..."* (Joint Secretariat 2015: 156).

Competition

In some regions of the Arctic polar bears and grizzly bears overlap in range and may compete for food sources.

During the open-water season, observations of feeding at a subsistence-harvested bowhead whale bone pile in Alaska indicated that grizzly bears were more socially dominant and displaced polar bears without aggressions. There were only rare observations of polar bear aggression towards grizzly bears (Miller et al. 2015).

Observations from TK holders tell of grizzly bears and polar bears feeding at sites where bowhead whales that have died from natural causes are beached, *"They are big animals and you have grizzlies and polar bears eating together. There is no conflict. There is so much food that they're just eating, eating, eating"* (Joint Secretariat 2015: 92).

Traditional knowledge furthermore indicates a presence of grizzly bears on ice in spring; a TK holder from Tuktoyaktuk never heard from his elders of grizzlies hunting on the sea ice but observed a grizzly bear hunting seal pups out on ice in April sometime around 2001, *“I’ve seen grizzly bears out in the ice hunting seals,”* (Joint Secretariat 2015: 90). A TK holder from Paulatuk mentioned hunters from his community are seeing more grizzly bears on the ice around their region in April and that they are scavenging seals killed by polar bears, *“they’re [grizzly bears] out on the ice looking for leftover polar bear kills come April. ’Cause the [polar] bears they just eat the fat, the oil from the seal”* (Joint Secretariat 2015: 91).

There are also documented accounts of grizzly bears killing polar bears. A hunter from Ulukhaktok said he saw a polar bear mother and cubs killed by a grizzly bear, in the Wynniatt Bay area on the north side of Victoria Island. In the same area, around 1994, hunters from Ulukhaktok found the remains of a polar bear that had just been killed by a grizzly bear. Its back legs had been torn off (Joint Secretariat, 2015).

Competition may also occur in mating. There are accounts of polar bears and grizzly bears mating. A TK holder from Paulatuk observed in April grizzlies following polar bear tracks; in March of 1996 he also observed a polar bear and a grizzly bear mating on ice (Joint Secretariat, 2015).

A hunter from Ulukhaktok also observed a hybrid male bear mating with a female polar bear just south of Banks Island (Joint Secretariat, 2015), making a second sighting in one year.

“The female was the polar bear. The male was the big half-breed.... It really was breeding with that polar bear. So, we might have another young polar-grizzly out there, hanging around.... [One can tell a bear is a hybrid from] the way it looks. It had a big hump on the back and big ears and his eyes were different. And also his claws. And also, he was not really white. But he was a big one” (Joint Secretariat, 2015: 92-93).

The first sighting that year was during Easter when a sport-hunting client of a Sachs Harbour hunter killed a hybrid bear near Nelson head:

“By its characteristics, I could tell its mother was a polar bear. The way she acted. It didn’t act like a grizzly bear or anything. It acted like a polar bear. Or it learned the ways of the barren land, the way that it walked. Where I tracked it for a ways after we got it, its characteristics was polar bear. You could see the way it hunts; it’s exactly like a polar bear. It was taught by its mother” (Joint Secretariat, 2015: 94).

There have been a total of 8 hybrid bears identified to date (through DNA) to be of grizzly bear-polar bear descent, all of which have occurred within the Banks and Victoria Island area (ENR pers comm.).

Other potential threats

Potential threats not assessed include noise (aircraft, snowmobiles), indirect habitat loss, and denning disturbance due to development. These threats are, however, managed through the regulatory system and current best practices and guidelines (see section 6, approach 4.3), and are restricted in scope.

4.7 Positive influences

Positive influences on polar bears in the ISR are factors likely to promote population growth. These can be classified into two main categories: 1) legislation and management; and 2) environmental changes.

The existence of a collaborative, coordinated, responsive joint management regime (described in section 2) has and continues to have a positive influence on polar bears in the ISR. This includes a well-established legislated system to manage and monitor harvest that has numerous features that promote polar bear conservation (see section 5). There are also well established mechanisms that facilitate the coordination and collaboration of polar bear management and conservation at various levels, from a local to international level (see Section 2).

While most environmental changes are anticipated to have a negative effect on polar bears, changes in the ice from multi-year (thick) ice to annual (thinner) ice may lead to an increase in the seal population and create improved hunting conditions for polar bears (Durner et al. 2009; Joint Secretariat 2015). In the short term, this could benefit polar bears particularly in northern parts of the ISR, although these potential benefits may not continue in the long term (e.g. next 100 years) (Durner et al. 2009; Stirling et al. 2011). In addition, changing spring sea ice conditions can lead to situations where hunter access to polar bears is limited, thereby easing harvest pressure on polar bears (Reidlinger 2001; W. Gully in Slavik 2011 in SARC 2012).

4.8 Knowledge Gaps

The following were identified as key areas where increased information would improve polar bear management in the ISR:

- Climate-induced changes in the Arctic ecosystem and the impacts these have on polar bears
 - Shifts in prey abundance, availability and subsequent impact on polar bear diet
 - Shifts in movements and distribution
 - Shifts in contaminant levels
- Ecosystem-level changes (e.g. range expansion of species, shifts in distribution and abundance of species) and the potential impacts on polar bears (e.g. prey, diseases, parasites, etc.)
- Effectiveness of alternative (less invasive/intensive) monitoring/research techniques for subpopulations in the ISR (e.g. aerial survey, power analysis identifying minimum number of captures required)
- Baseline contaminant levels related to oil and gas activities
- Understanding current disease exposure and parasite loads

- Understanding of sub-lethal impacts of contaminants/pollution and disease/parasites at an individual and population level
- Amount of shipping that is occurring, including cargo (what they are carrying), routes, and season (are ice-breakers used?), how this might change in the future, and the potential impact on polar bears
- The relative importance of the different threats to polar bear and how they interact (cumulative effects).

5. CURRENT HARVEST MANAGEMENT SYSTEM

There are well established systems to manage and monitor polar bear harvest in the ISR. Total Allowable Harvest (TAH) levels for polar bears are set in accordance with the mechanisms in the IFA and involve community consultations. Harvest levels, along with the most recent information on subpopulations, are reviewed annually by the WMACs, IGC, and commissioners³ under the relevant user-to-user agreements. Relevant joint management authorities provide recommendations regarding TAH adjustments as required to achieve management objectives. Depending on the subpopulation, TAH is subject to final acceptance by the territorial and federal ministers as appropriate.

The harvest management system is adaptive. If TK, LK or scientific monitoring indicates a subpopulation has declined and the objective is to maintain the population, a potential response could be to reduce the TAH to facilitate growth of the population. This mechanism has been previously employed in the ISR. Historically, in absence of population estimates, quotas were set too high in the Viscount-Melville Sound area and declines in the number of bears were reported. Subsequently a VM subpopulation survey (1989-1992) was conducted and based on the results, a 5 year moratorium on harvest was implemented. After the moratorium, harvest levels were set with the objective to increase the population; this was done using information from population viability modelling. These actions were recommended and implemented in the ISR through the joint management process and applicable legislation (HTC by-laws).

Additional features of the harvest management system provide for conservation of the species. All human-caused mortality (including kills made in defence of life and property, research mortalities, and illegal harvests) are counted under the quota. Quotas are set based on a female harvest that does not exceed 1/3 of the quota. Harvest of a bear in a den, constructing a den, or accompanied by a cub is prohibited. Hunting seasons were established to allow pregnant females to establish maternity dens. Inuvialuit are permitted to transfer their exclusive hunting rights to other guided hunters. When this occurs the tag allocated to the guided hunter cannot be reallocated if the hunt is unsuccessful.

³ Commissioners: The SB subpopulation is shared with Alaska and managed under the 1988 Inuvialuit- Inupiat agreement. The quota is recommended under the principles of this agreement by the designated commissioners of the North Slope Borough and the Inuvialuit Game Council, and technical advisors.

Under the system, the use of a tag, harvest reporting, and sample collection (including proof of sex and tooth) are mandatory under the HTC by-laws. This ensures information is available for management purposes. Additional samples are regularly submitted by harvesters to support different research projects. Polar bears in the ISR have been managed under quota since the 1960s and there is currently excellent understanding and compliance at a local level. For a history of harvest management in each subpopulation, see Appendix B.

6. MANAGEMENT ACTIONS AND APPROACHES TO ACHIEVE OBJECTIVES

Polar bear management in the ISR is a success story with a long history. The Inuvialuit people have informally managed the species for generations and in recent decades have been leaders in developing landmark agreements like the 1988 Inuvialuit-Inupiat user-to-user agreement. Government management actions date back to the 1960s. The current joint management regime for polar bears in the ISR has proven to be successful (further described in section 5).

A large number of actions that support the objectives in this management plan are completed or ongoing. These actions are discussed below under each recommended approach to achieve identified management objectives. Approaches under each objective, their relative priority and timeframe, and how they will be measured are summarized in Table 4. The *Framework for Action* will be used to develop an implementation table that identifies actions with leads, priorities and timeframes. This table will serve as the foundation for the future ISR polar bear implementation agreement. The implementation agreement is a separate document to be completed following official ministerial approval of this management plan.

Objective 1: Collect traditional knowledge, scientific knowledge and monitoring information in a timely manner to inform management decisions

Science provides knowledge based on population research and monitoring, while TK offers information acquired over many generations of experience. These sources of information along with harvest monitoring are essential for effective management. A collaborative approach between TK holders, academic and government researchers, and harvesters, can provide a more complete understanding. The knowledge gained through traditional knowledge, science, and harvest monitoring should be reported to management authorities in a timely manner to inform management decisions.

Approach 1.1: Document traditional knowledge and use traditional knowledge to inform management decisions on an ongoing basis

In 2015, the WMACs released their report titled *Inuvialuit and Nanuq: A Polar Bear Traditional Knowledge Study* (Joint Secretariat 2015). This report has been compiled from a NVivo database of traditional knowledge about polar bear behaviour, ecology, and distribution collected from more than 70 TK knowledge holders in the six ISR communities. There has also been work to map denning habitat using both science and TK. The collection and analysis of TK regarding polar bears and their habitat should continue, and knowledge gathered should be made available to not only inform management decisions but also to use in the planning and execution of research and monitoring

programs. More systematic collection of Inuvialuit observations of polar bears would facilitate the application of knowledge gathered for management purposes. Guidelines have been finalized for conducting TK research (Armitage and Kilburn 2015) based on the experience from the 2015 Joint Secretariat report, and these should be employed in the ISR.

Approach 1.2: Monitor contaminants in polar bears

Ocean-borne and air-borne contaminants, as well as contaminants related to local resource development and extraction can have health effects on polar bears and prey. Where needed, baseline information on contaminants in polar bears should be collected, and contaminants monitoring should continue on a regular basis. A long-term monitoring plan for contaminants should be developed. A collaborative approach (inter-jurisdictional and international) is warranted; consideration of contaminant monitoring in prey is important.

Approach 1.3: Monitor polar bear subpopulations

Monitoring subpopulations is necessary to inform management decisions and assess whether management actions are appropriate and are addressing threats. Monitoring includes subpopulation surveys, the collection of harvest data, the collection and investigation of samples collected from subpopulation surveys and harvests, and knowledge/information collected regarding polar bear habitat (ice conditions, etc.) and prey species. Information gathered through monitoring can be used at various scales from investigation of regional concerns through to broader ecological questions that apply across polar bear subpopulations (e.g., climate change effects, genetic studies, etc.).

Scientific studies of polar bears in the ISR date back to the 1970s. Following the completion of current analysis of new data from the Viscount Melville Sound subpopulation, polar bear subpopulations in the ISR, with the exception of the Arctic Basin, will have been assessed at least twice since the signing of the international *Agreement on the Conservation of Polar Bears*. Assessments of polar bear subpopulations should continue at regular intervals, and alternative methods of surveying subpopulations while minimizing impacts on bears should be investigated. Evaluation of subpopulation boundaries should also continue as conditions change and new information becomes available.

In the ISR, mandatory reporting including information on location and submissions of proof of age and sex is required from all human-caused polar bear mortalities. This regulation has been in place for decades and compliance at a local level is excellent. Additional sample collections from harvests occur periodically for a variety of projects (i.e. contaminants monitoring, diet analysis, etc) and should continue.

Over the long term, monitoring data (from various sources) can be used to detect and understand changes in the status of polar bear subpopulations. Research to address broader ecological questions that apply across polar bear subpopulations (e.g., climate change effects, genetic studies, movement patterns, contaminants) is currently underway by government and academic researchers, and often involves use of samples collected through harvester cooperation.

A polar bear health monitoring plan should be developed to guide the collection and analysis of information and samples. The plan should include strategies to monitor polar bear condition, diet, disease, parasites, contaminant levels, and indicators of stress, and investigate potential implications of these factors on polar bear health (e.g. development, reproduction, behaviour, etc.). Such a plan will likely require additional investments from harvesters, and further collaborations with researchers outside the ISR. For this reason, guidelines/protocols for data sharing will be required.

Approach 1.4: Consider best available information on habitat and prey in polar bear management

Information regarding seals in the ISR is important for polar bears because, as their main food source, changes to the seal abundance/distribution/health will undoubtedly have impacts on polar bears. Communication with relevant organizations/agencies is required to ensure that TK, LK, and scientific information on seals in the ISR is available for consideration in polar bear management decisions.

Sea ice provides the main habitat for polar bears; therefore changes to sea ice distribution, condition, characteristics, and the timing of growth and ablation of sea ice in the ISR have potential impacts on polar bears. Communication with relevant organizations/agencies is required to ensure that information regarding sea ice coverage and conditions and associated timing is considered in polar bear management decisions.

Objective 2: Adaptively co-manage polar bears and their habitat in accordance with the best information available

Polar bears are co-managed in the ISR with an adaptive management approach. The current joint management process, along with several formal agreements and plans already in place, support this approach through coordination and collaboration (described in detail in section 2.2.9).

Approach 2.1: Review information annually to inform adaptive management

On an annual basis, joint management authorities in the ISR (WMACs and IGC) review the best available information on polar bears to make management recommendations and identify research priorities as required in consideration of management objectives for each polar bear subpopulation. This process occurs in collaboration with jurisdictions that share management authority for shared polar bear subpopulations.

At scheduled annual meetings, polar bear management authorities should review progress made as it relates to this management plan, the companion *Framework for Action* document, and the implementation table (once complete). This annual review should be a standing agenda item within an existing forum (e.g. at regularly scheduled joint meetings of the WMACs, at annual Inupiat-Inuvialuit meetings, etc.).

Approach 2.2: Communicate with harvesters and local communities to foster information flow in both directions

Inuvialuit people have an important role to play in managing the polar bear and ensuring its survival. Continued exchange of information with Inuvialuit is an essential part of this plan. Communication among governments, WMACs, researchers, IGC, HTC and ISR

community members about polar bears happens through various means including IGC, HTC, community meetings, the ISR Research Day, and more informally through one-on-one communication between community members and staff employed in the above noted organizations.

Approach 2.3: Coordinate with other jurisdictions on a national and international level

It is important to work with other jurisdictions to foster the sharing of information, coordinate research and monitoring, and cooperate regarding polar bear management. Inter-jurisdictional coordination occurs at various levels as outlined in section 2. For shared polar bear subpopulations, there are annual Inuvialuit-Inuit and Inuvialuit-Inupiat meetings held in relation to respective bilateral user-to-user agreements. These meetings function to review information on polar bears and make recommendations for research and management as required. Joint management organizations in the ISR participate in various technical and advisory committees, and other national and international fora concerning polar bear monitoring and management. The national PBTC provides a venue to discuss technical issues and share technical advice that, in turn, is reported back to the PBAC, who fosters a national coordination of management. ISR organizations actively participate through the Inuit Communications Group for polar bears. Governments, WMACs and Inuvialuit organizations also work with other countries to ensure that polar bear trade is appropriately monitored and managed under CITES.

Objective 3: Encourage wise use of polar bear populations and all polar bear products

Polar bear harvesting is very important to the Inuvialuit people from a cultural, spiritual, economic, and subsistence perspective. Integral to this objective is managing harvest wisely. The current harvest management system (explained in detail in section 5) contains various features to facilitate the wise use of polar bear populations and their products.

Approach 3.1: Continue to encourage a male-dominated harvest

Growth of polar bear subpopulations is directly related to the ability of reproductive females to successfully rear cubs. Polar bear harvesting quotas in the ISR are set based on a Total Allowable Harvest under the principle that females do not exceed one third of the total subpopulation quota.

Inuvialuit-Inuit and Inuvialuit-Inupiat user-to-user agreements and existing HTC by-laws have objectives and regulations that act to protect female polar bears. They provide increased protection to female polar bears by encouraging that the female proportion of the harvest not exceed one-third of the sustainable total. They furthermore have regulations that protect all bears in dens and constructing dens, as well as all members of a family group (a mother with one or more cubs-of-the-year or yearlings). When there is a concern regarding the female proportion of the harvest exceeding one-third of the sustainable total, appropriate actions (determined through the joint management process) are undertaken to address the situation. As an example, following an IGC recommendation, community workshops were held to educate young hunters on how to identify the sex of polar bears, as well as, the importance of a reduced female harvest; this action was effective.

Approach 3.2: Manage human-caused mortalities so they do not exceed the quota

The harvest of polar bear in the ISR is controlled through a quota system with harvest quotas established and reviewed following joint management and adaptive management processes described in section 2. Quotas (TAHs) have been established for each polar bear subpopulation, and are inclusive of both intentional mortalities (harvests) and unintentional mortalities (e.g. those related to defense of life and property, industrial activities, human-bear conflict, etc.). The harvest system employs the use of tags to track mortalities and ensure the quota is not exceeded.

Approach 3.3: Continue to manage guided hunts to achieve conservation benefits

Inuvialuit have exclusive rights to harvest polar bears in the ISR in accordance with the IFA. Inuvialuit may choose to transfer their hunting rights through a process involving allocating hunting tags to non-resident hunters that are guided by Inuvialuit. Tags for guided hunts are not reallocated if the hunt is unsuccessful and thus have a conservation implication because the tag is counted as part of the quota: however there is no associated harvested bear.

Approach 3.4: Continue to regulate polar bear trade

To encourage the wise use of the polar bear population and all polar bear products is also an objective of the Inuvialuit-Inupiat and Inuvialuit-Inuit user-to-user agreements. The Inuvialuit-Inupiat agreement states that each jurisdiction shall prohibit the exportation from, the importation and delivery into, and traffic within its territory, of polar bears or any part of product thereof taken in violation of this Agreement. Inuvialuit also discourage the export of gall bladders and paws recognizing the underground market implications of these products. Fundamental to regulating trade of polar bears is the employment of a permitting system. Permits continue to be required for domestic and international export of bears taken in the ISR and new technologies are being explored to improve the traceability of individual hides, i.e., use of PIT tags (passive integrated transponders).

Approach 3.5: Explore tools to investigate impacts of harvest on subpopulation trend

The impact of harvesting from a population that is declining due to environmental factors that may be causing the carrying capacity to decline is complicated. To encourage the wise use of the polar bear population and all polar bear products is an objective of the Inuvialuit-Inupiat and Inuvialuit-Inuit user-to-user agreements. In order to investigate the impacts of harvest on subpopulation trend a model has been developed (Regehr et al. 2015) and workshops are planned to better understand the model and discuss its application in the ISR.

Objective 4: Minimize detrimental effects of human activities on polar bears and their habitat

Human activities (such as industrial exploration and development, research, tourism and shipping) can have unintended impacts on polar bears. These can include habitat change, disturbance of bears, effects on health, and even mortality. This objective aims to prevent or minimize those negative impacts.

Approach 4.1: Minimize detrimental effects of human-bear conflicts

Human-bear conflicts often result in a negative outcome for the bear (e.g. mortality or injury as a result of action taken in defense of life and property, separation of mothers from dependent cubs). The number of human-bear conflicts could be reduced by developing and promoting best practices and guidelines for working in polar bear habitat (e.g. reducing attractants, safe deterrence of polar bears, and bear awareness training).

An international Polar Bear-Human Information Management System (PBHIMS) has been developed and work is underway to implement this system in the ISR. The systematic collection of data on human-bear conflicts facilitates information being available for adaptive management, particularly as more is learned about human-bear conflicts.

Joint management partners continue to work to reduce human-bear conflicts in communities in the ISR (e.g. by reducing attractants), and there are now renewable resource personnel in each community to support these efforts. Supporting community bear patrols can also help to minimize human-bear conflicts. Additionally, the existing wildlife research permitting process for all types of research encourages researchers to minimize their impacts on polar bears and their habitat through feedback from organizations who review permits.

Approach 4.2: Minimize detrimental effects of research on polar bears

Research techniques such as collaring, capture, and immobilization can have negative impacts on polar bears. Work is underway to better understand these effects through the sharing of information on bears handled and any documented impacts (currently occurring through the NWT Wildlife Care Committee reporting process, and also at the PBTC level). Further research regarding the impacts of handling is warranted. Alternate less invasive methods for subpopulation monitoring are being investigated (e.g. aerial survey methods). The need for polar bear research and monitoring should be evaluated alongside information it will provide and in consideration of potential impacts. Advice regarding how impacts on polar bears can be minimized primarily occurs through the NWT Wildlife Care Committee review, permitting, and reporting process, however, can also occur through the wildlife research permitting process. Agencies in the ISR will continue to advocate for a power analysis of existing data to inform sample size and methodology decisions in polar bear research.

Approach 4.3: Minimize detrimental effects of development and industrial activity on polar bears

There are several ways in which potential negative impacts of industry and other human activities on polar bears and their habitat can be mitigated. These include identifying and mitigating impacts through the regulatory system; identifying key habitats where special care is needed to operate (e.g., denning habitat) or seasonal and long-term “no-go” areas identified; developing protocols for industry, and shipping traffic to avoid disturbance of polar bears; developing an oil spill response plan specific to polar bears; and tracking cumulative impacts of human activity on polar bear habitat.

The WMACs, IGC, and governments provide information and guidance into processes of screening, environmental impact assessment and project approvals, on how to minimize impacts of development on polar bears and their habitat. This primarily occurs through the EISC and EIRB. The EISC acts to identify proposed developments that could have a significant negative environmental impact and the EIRB carries out detailed environmental impact assessments and public reviews of development projects. EIRB determines whether a project should proceed and, if so, under what specific terms and conditions, with recommendations to the appropriate federal and territorial ministers.

Polar bear dens are protected under both the NWT and Yukon Wildlife Acts. Furthermore, joint management partners work with industry to identify and survey potential denning habitat and, when necessary, implement exclusion zones and enhanced monitoring around active dens.

There are several protected areas within the ISR polar bear range, including National Parks, Migratory Bird Sanctuaries, Territorial Parks, and Marine Protected Areas.

With respect to marine-based tourism, a suite of guidelines have been developed by the Association of Arctic Expedition Cruise Operators to avoid or minimise adverse effects on polar bears among other species (<http://www.aeco.no/>).

There are also various international treaties that aim to eliminate or restrict the production and use of pollutants (e.g. the 2004 *Stockholm Convention on Persistent Organic Pollutants*).

Objective 5: Communicate and share information on polar bears and impacts of climate change on polar bears

Communicating information regarding polar bears and how they are impacted by climate change with audiences within and beyond the ISR helps to build and maintain support for adaptive joint management of polar bears in the ISR. Furthermore, it increases awareness of the effects of climate change on polar bears and encourages action to reduce greenhouse gas emissions.

Approach 5.1: Encourage youth stewardship of polar bears in the ISR

Communicating and sharing information effectively with youth is equally as important as with their parents (see approach 2.2). Youth become the next generation of harvesters and managers and it is essential to convey messages that promote stewardship. Elders in particular have noted the importance of passing along TK to the youth in their communities. There are a number of ways for youth to acquire knowledge about polar bears, including participating in hunting, attending HTC and other meetings, social media, online, and through books and oral history. Information is shared through generations, and in this way, responsible polar bear users and stewards are developed for generations to come.

Approach 5.2: Enhance national and international communications with a particular focus on climate change impacts on polar bears

Polar bears are a high profile species that gains attention from diverse audiences at multiple jurisdictional levels. Perspectives regarding polar bear management are widespread. For this reason, effective national and international communication is essential. Promoting the adaptive manner in which polar bears are co-managed within the ISR builds support and understanding and facilitates others to learn from the ISR's model.

The IGC, WMACs, and governments participate in various national and international conferences and events to communicate how polar bears are managed in the ISR and in Canada, as well as the cultural importance of polar bears to the Inuvialuit and Inuit. On an international level, joint management partners have developed fact sheets on polar bear management in Canada, as well as specifically within the NWT. Information on polar bears in Canada is available from various avenues and efforts are underway to consolidate and share information through websites.

It is important to communicate with national and international audiences regarding the effects of climate change on polar bears. Effective communication can encourage action at various levels (from individual to national), which is necessary to reduce greenhouse gas emissions and mitigate climate change, therefore reducing its impact on polar bears.

7. MEASURING PROGRESS

Management will be considered successful if the overall goal is achieved; that is, ensuring the long-term persistence of healthy polar bears in the ISR while maintaining traditional Inuvialuit use. A measure of overall success will be if the status of polar bear has not become threatened or endangered when reassessed (as indicated by its status in NWT as assessed by SARC every 10 years, and its status in Canada as assessed by COSEWIC every 10 years). Another measure of overall success will be if the population allows for continued subsistence harvest and use of polar bears (as indicated by the Total Allowable Harvest (TAH) available).

In order to measure progress, the partners have agreed to performance measures for each approach under the five objectives (Table 4). Five years after the signing of the plan, the management agencies for polar bear in the ISR will report on progress under this management plan. The performance measures and indicators in Table 4 may be used to measure progress.

Table 4. Management approaches to achieve objectives identified

Management approach	Relative Priority ¹ / Timeframe ²	Threats and/or knowledge gaps addressed	Performance Measure ³	Indicator/Target
Objective #1: Collect traditional knowledge, scientific knowledge and monitoring information in a timely manner to inform management decisions				
1.1 Document traditional knowledge and use traditional knowledge to inform management decisions on an ongoing basis	Critical / Ongoing	Potential to address knowledge gaps and provide information on threats	Traditional knowledge is collected and available Traditional knowledge is integrated into polar bear assessments	Information has been collected and is accessible to managers Use of traditional knowledge in polar bear status assessments
1.2 Monitor contaminants in polar bears	Beneficial Short term and Ongoing	Impacts of offshore oil and gas exploration and development (including oil spills) Pollution and the accumulation of environmental contaminants Shifts in contaminant levels Baseline contaminant levels related to oil and gas activities	Baseline levels are established for key contaminants Contaminants monitoring program is in place	Baseline information available Approved monitoring plan and reports on its implementation
1.3 Monitor polar bear subpopulations	Critical Ongoing	Habitat change due to climate change Disease Shifts in movements and distribution Understanding of sub-lethal impacts of contaminants and	Subpopulation inventories are conducted with partners at an appropriate frequency Information on polar	New subpopulation estimates completed and results provided to decision makers and communities Information on polar bear health and

Management approach	Relative Priority ¹ / Timeframe ²	Threats and/or knowledge gaps addressed	Performance Measure ³	Indicator/Target
		disease at an individual and population level Human-caused mortality Competition	bear health and condition is collected and available	condition has been collected and is accessible to managers
1.4 Consider best available information on habitat and prey in polar bear management	Critical Ongoing	Shifts in prey abundance, availability and subsequent impact on polar bear diet Habitat change due to climate change Climate-induced changes in the Arctic ecosystem and the impacts these have on polar bears	Information on habitat and prey is taken into account in management	Information made available and considered by managers
Objective #2: Adaptively co-manage polar bears and their habitat in accordance with the best information available				
2.1 Review information annually to inform adaptive management	Critical Ongoing	Addresses all threats	Management partners share information about the subpopulations and review management on a regular basis Quota reviewed annually	Management partners meet annually to review information and consider management recommendations (including those from Inuvialuit-Inuit and Inuvialuit-Inupiat) Status report for species under quota is provided annually to boards
2.2 Communicate with harvesters and local communities to foster information flow in both	Critical Ongoing	Potential to address knowledge gaps and provide information on threats	Communities and HTC's are informed about polar bear management issues	Polar bear management documents/products provided to HTC's and communities

Management approach	Relative Priority ¹ / Timeframe ²	Threats and/or knowledge gaps addressed	Performance Measure ³	Indicator/Target
directions			Managers are informed about community and HTC concerns/priorities	Concerns/priorities are addressed appropriately
2.3 Coordinate with other jurisdictions on a national and international level	Necessary Ongoing	Potential to address knowledge gaps and provide information on threats	ISR issues are brought to national and international meeting fora	Partners attend and provide updates at meetings of: Inuvialuit-Inupiat Inuit –Inuvialuit Polar Bear Technical Committee Polar Bear Administrative Committee Polar Bear Specialist Group Range states (biennial) Canada-US oversight group Relevant national Inuit agencies Federal government coordination groups
Objective #3: Encourage wise use of polar bear populations and all polar bear products				
3.1 Continue to encourage a male-dominated harvest	Critical Ongoing	Human-caused mortality	Female mortalities do not repeatedly exceed one third of quota	Total number of female polar bear human-caused mortalities in relation to the quota
3.2 Manage human-caused mortalities so they do not exceed the quota	Critical Ongoing	Human-caused mortality	Number of human-caused mortalities (from all sources) remains at or under quota Number of bear-human occurrences	Total number of polar bear human-caused mortalities in relation to the quota Number of DLPs (defense of life and property mortalities)

Management approach	Relative Priority ¹ / Timeframe ²	Threats and/or knowledge gaps addressed	Performance Measure ³	Indicator/Target
			resulting in bear fatalities does not increase	
3.3 Continue to managed guided hunts to achieve conservation benefits	Necessary Ongoing	Human-caused mortality	Regulation maintained that unsuccessful guided hunt tags cannot be reallocated	Track success rate of guided hunts
3.4 Continue to regulate polar bear trade	Necessary Ongoing	Human-caused mortality	Provincial/territorial export permits and CITES export permits are required and tracked with appropriate confirmation of non-detrimental findings Mechanisms in place to improve tracking	Trade data provided annually
3.5 Explore tools to investigate impacts of harvest on subpopulation trend.	Necessary Short Term	Human-caused mortality	Decision and use of appropriate tool(s) to examine impacts of harvest on subpopulation trend.	Workshop held to research harvest impacts model(s) and consider their application in ISR.
Objective #4: Minimize detrimental effects of human activities on polar bears and their habitat				
4.1 Minimize detrimental effects of human-bear	Necessary Ongoing	Human-caused mortality	Number of bear-human conflicts does not increase	Recording of bear-human conflicts by international standards

Management approach	Relative Priority ¹ / Timeframe ²	Threats and/or knowledge gaps addressed	Performance Measure ³	Indicator/Target
conflicts			Proportion of bear-human conflicts resulting in bear injury or fatality does not increase	Number of bear- human conflicts resulting in bear injury or fatality
4.2 Minimize detrimental effects of research on polar bears	Necessary Ongoing	Invasive research techniques used on bears Effectiveness of alternative (less invasive) monitoring\ research techniques for subpopulations in the ISR	Less invasive/ intensive techniques are being researched and are being employed	Number of bears handled or immobilized Number of injuries or mortalities related to research method
4.3 Minimize detrimental effects of development and industrial activity on polar bears	Critical Ongoing	Impacts of offshore oil and gas exploration and development (including oil spills) Marine traffic	Guidance and protocols on best practices are available and used during regulatory process Best available information is accessible for mitigation purposes	Guidance and protocols referenced and accepted in regulatory decisions Polar bear information is used for mitigation purposes in regulatory decisions
Objective #5: Communicate and share information on polar bears and impacts of climate change on polar bears				
5.1 Encourage youth stewardship of polar bears in the ISR	Necessary Ongoing	Human-caused mortality Bear-human conflicts Habitat change due to climate change	Knowledge level of youth has increased with respect to polar bear management	Number of engagements with youth

Management approach	Relative Priority ¹ / Timeframe ²	Threats and/or knowledge gaps addressed	Performance Measure ³	Indicator/Target
5.2 Enhance national and international communications with a particular focus on climate change impacts on polar bears	Beneficial Ongoing	Habitat change due to climate change	Products and information are available to a global audience	Website visitation and number of downloads Number of media/public engagements and presentations (local and international)

¹**Relative priority** can be *critical*, *necessary* or *beneficial*. *Critical* approaches are the highest priority for the conservation of polar bear and should be implemented sooner rather than later. *Necessary* approaches are important to implement for the conservation of polar bear but with less urgency than *critical*. *Beneficial* approaches help to achieve management goals but are less important to the conservation of the species compared to *critical* or *necessary*.

²**Relative timeframe** can be *short-term*, *long-term*, or *ongoing*. *Short-term* approaches should be completed within five years and *long-term* approaches require more than five years to complete. *Ongoing* approaches are long-term actions carried out repeatedly on a systematic basis.

³ Implementation of this joint management plan and companion document is subject to appropriations, priorities, and budgetary constraints of the participating management organizations. This table represents guidance from all partners as to the priority of the approaches and appropriate measure of performance.

8. NEXT STEPS

The *Framework for Action*, a companion document to the *ISR Polar Bear Joint Management Plan* will be used to develop an implementation table. The table will provide the basis for the ISR polar bear implementation agreement, which will be produced after official ministerial approval of this management plan.

In five years the management agencies for polar bear in the ISR will formally report on progress under this management plan. In ten years, or at the request of a management partner, this management plan and the accompanying *Framework for Action* will be reviewed and revised as required. This process will continue as long as polar bear is listed as a species of special concern under the *Species at Risk (NWT) Act* and/or the federal *Species at Risk Act (SARA)*.

This management plan may be adopted under the *Species at Risk (NWT) Act* and/or federal SARA processes.

This management plan does not commit any party to actions or resource expenditures; implementation of this plan is subject to budgetary appropriations, priorities, and constraints of the participating management agencies.

REFERENCES

- Aboriginal Affairs and Northern Development Canada (AANDC). 2015. Northern oil and gas annual report 2014. Aboriginal Affairs and Northern Development Canada. Available online: <https://www.aadnc-aandc.gc.ca/eng/1431106507542/1431106696195> [Accessed February 18, 2016].
- Agreement on the Conservation of Polar Bears (International). 1973. The Governments of Canada, Denmark, Norway, the Union of Soviet Socialist Republics and the United States of America. Available online: http://www.registrelep-sararegistry.gc.ca/document/default_e.cfm?documentID=74 [Accessed June 2, 2016].
- Alaska Dispatch News. 2015. Available online: <http://www.adn.com/article/20150906/locals-biologists-free-polar-bear-caught-fishing-net-arctic-alaska> [Accessed February 18, 2016].
- Armitage, P. and S. Kilburn. 2015. Conduct of Traditional Knowledge Research—A Reference Guide. Wildlife Management Advisory Council (North Slope), Whitehorse, YT. Available online: http://www.wmacns.ca/pdfs/401_ConductOfTraditionalKnowledge_Sept14_fnl_WEB.pdf [Accessed October 6, 2016].
- Amstrup, S. C. 1993. Human disturbances of denning polar bears in Alaska. *Arctic* 46(3): 246-250.
- Amstrup, S. C., G. M. Durner, T. L. McDonald, and W. R. Johnson. 2006. Estimating potential effects of hypothetical oil spills on polar bears. U.S. Department of the Interior, U.S. Geological Survey, Report. 56 pp.
- Arctic Council. 2009. Arctic Marine Shipping Assessment 2009 Report. Arctic Council. Available online: http://www.arctic.noaa.gov/detect/documents/AMSA_2009_Report_2nd_print.pdf [Accessed February 18, 2016].
- Arctic Monitoring and Assessment Programme (AMAP). 2005. AMAP Assessment 2002 - Persistent Organic Pollutants in the Arctic. Arctic Monitoring and Assessment Programme, Oslo, Norway.
- Arctic Monitoring and Assessment Programme (AMAP). 2010. AMAP Assessment 2009 - Persistent Organic Pollutants (POPs) in the Arctic. *Science of the Total Environment Special Issue*. 408:2851-3051. Elsevier.
- Arctic Monitoring and Assessment Programme (AMAP). 2011. AMAP Assessment 2011: Mercury in the Arctic. Arctic Monitoring and Assessment Programme, Oslo, Norway.
- Atwood, T., E. Peacock, K. Burek-Huntington, V. Shearn-Bochsler, B. Bodenstein, K. Beckmen, and G. Durner. 2015. Prevalence and spatio-temporal variation of an alopecia syndrome

- in polar bears (*Ursus maritimus*) of the southern Beaufort Sea. *Journal of Wildlife Diseases* 51:48-59.
- Bradley, M. J., S. J. Kutz, E. Jenkins, and T. M. O'Hara. 2005. The potential impact of climate change on infectious diseases of Arctic fauna. *International Journal of Circumpolar Health* 64:468-477.
- Canada National Parks Act*. (S.C. 2000, c.32). Available online: <http://laws-lois.justice.gc.ca/PDF/N-14.01.pdf> [Accessed: June 2, 2016].
- Canadian Environmental Assessment Act* (S.C. 2012. C. 19, s.52). Available online: <http://laws-lois.justice.gc.ca/PDF/C-15.21.pdf> [Accessed: June 2, 2016].
- Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). 2016. Appendix I, II and III. Available online: <https://cites.org/sites/default/files/eng/app/2016/E-Appendices-2016-03-10.pdf> [Accessed: June 2, 2016].
- COSEWIC. 2008. COSEWIC assessment and update status report on the polar bear *Ursus maritimus* in Canada. Committee on the Status of Endangered Wildlife in Canada, Ottawa, ON. vii + 75 pp.
- Derocher, A. E., N. J. Lunn, and I. Stirling. 2004. Polar bears in a warming climate. *Integrative and Comparative Biology* 44:163-176.
- Durner, G. M., D. C. Douglas, R. M. Nielson, S. C. Amstrup, T. L. McDonald, I. Stirling, M. Mauritzen, E. W. Born, Ø. Wiig, E. DeWeaver, M. C. Serreze, S. E. Belikov, M. M. Holland, J. Maslanik, J. Aars, D. A. Bailey, and A. E. Derocher. 2009. Predicting 21st-century polar bear habitat distribution from global climate models. *Ecological Monographs* 79:25-58.
- Durner, G. M., J. P. Whiteman, H. J. Harlow, S. C. Amstrup, E. V. Regehr, and M. Ben-David. 2011. Consequences of long-distance swimming and travel over deep-water pack ice for a female polar bear during a year of extreme sea ice retreat. *Polar Biology* 34:975-984.
- Elmore, S. A., E. J. Jenkins, K. P. Huyvaert, L. Polley, J. J. Root, and C. G. Moore. 2012. *Toxoplasma gondii* in circumpolar people and wildlife. *Vector-Borne and Zoonotic Diseases* 12:1-9.
- ENR. 2015. NWT State of the Environment Report. 7. Human Activities: Trends in Shipping in the Northwest Passage and the Beaufort Sea. Environment and Natural Resources, Government of the Northwest Territories. Available online: <http://www.enr.gov.nt.ca/state-environment/73-trends-shipping-northwest-passage-and-beaufort-sea> [Accessed March 31, 2016].
- Fagre, A. C., K. A. Patyk, P. Nol, T. Atwood, K. Hueffer, and C. Duncan. 2015. A review of infectious agents in polar bears (*Ursus maritimus*) and their long-term ecological relevance. *Ecohealth* 12:528-539.

- Forbes, L. B. 2000. The occurrence and ecology of *Trichinella* in marine mammals. *Veterinary Parasitology* 93:321-334.
- Fischbach, A., S. Amstrup, and D. Douglas. 2007. Landward and eastward shift of Alaskan polar bear denning associated with recent sea ice changes. *Polar Biology* 30:1395-1405.
- Griswold J., T. McDonald, M. Branigan, E. V. Regeher, and S. C Amstrup. Unpublished. Southern and northern Beaufort Sea polar bear population estimates under a proposed boundary shift. Draft Manuscript Report.
- Hunter, C. M., H. Caswell, M. C. Runge, E. V. Regehr, S. C. Amstrup, and I. Stirling. 2010. Climate change threatens polar bear populations: a stochastic demographic analysis. *Ecology* 91:2883-2897.
- Indian and Northern Affairs Canada (INAC). 2007. Oil and Gas Exploration & Production in the Northwest Territories. Petroleum Development Division, Indian and Northern Affairs Canada, Yellowknife, NT. Available online: <https://www.aadnc-aandc.gc.ca/eng/1100100023703/1100100023705> [Accessed May 25, 2016].
- Inuvialuit Final Agreement (IFA) The Western Arctic Claim. 1984. Indian and Northern Affairs Canada, Ottawa, ON. Available online: http://www.eco.gov.yk.ca/aboriginalrelations/pdf/western_arctic_claim_inuvialuit_fa.pdf [Accessed June 2, 2016].
- Inuvialuit-Inupiat Polar Bear Management Agreement in the Southern Beaufort Sea. 1988. Available online: <http://www.fws.gov/alaska/fisheries/mm/polarbear/pdf/I-I%20Agreement%20signed%20March%202000.pdf> [Accessed June 2, 2016].
- Jeffries, M. O., J. E. Overland, and D. K. Perovich. 2013. The Arctic shifts to a new normal. *Physics Today* 66(10); doi: 10.1063/PT.3.2147.
- Jensen, S. K., J. Aars, C. Lydersen, K. M. Kovacs, and K. Asbakk. 2010. The prevalence of *Toxoplasma gondii* in polar bears and their marine mammal prey: evidence for a marine transmission pathway. *Polar Biology* 33:599-606.
- Joint Secretariat. 2015. Inuvialuit and Nanuq: A Polar Bear Traditional Knowledge Study. Joint Secretariat, Inuvialuit Settlement Region. xx + 304 pp. Available online: http://www.wmacns.ca/pdfs/394_polar-bear-tk-report-low-res.pdf.
- Kirk, C., S. Amstrup, R. Swor, D. Holcomb, and T. O'Hara. 2010. Morbillivirus and *Toxoplasma* exposure and association with hematological parameters for southern Beaufort Sea polar bears: potential response to infectious agents in a sentinel species. *EcoHealth* 7:321-331.
- McKinney, M. A., S. J. Iverson, A. T. Fisk, C. Sonne, F. F. Rigét, R. J. Letcher, M. T. Arts, E. W. Born, A. Rosing-Asvid, and R. Dietz. 2013. Global change effects on the long-term feeding ecology and contaminant exposures of East Greenland polar bears. *Global Change Biology* 19:2360-2372.

- Miller, S., J. Wilder, and R. R. Wilson. 2015. Polar bear–grizzly bear interactions during the autumn open-water period in Alaska. *Journal of Mammalogy* DOI:10.1093/jmammal/gyv140.
- Memorandum of Understanding between Environment Canada and the United States Department of the Interior for the Conservation and Management of Shared Polar Bear Populations. 2008. Environment Canada. Available online: <https://www.ec.gc.ca/international/default.asp?lang=En&n=6D70FB59-1> [Accessed June 2, 2016].
- Monnett, C. and J. Gleason. 2006. Observations of mortality associated with extended open-water swimming by polar bears in the Alaskan Beaufort Sea. *Polar Biology* 29:681-687.
- National Conservation Strategy. 2011. National Polar Bear Conservation Strategy for Canada. Available online: <http://ec.gc.ca/nature/default.asp?lang=En&n=60D0FDBD-1> [Accessed February 19, 2016].
- National Oceanic and Atmospheric Administration (NOAA) Marine Debris Program. 2014 Report on the Occurrence and Health Effects of Anthropogenic Debris Ingested by Marine Organisms. Silver Spring, MD. 19 pp.
- O'Hara, T. M., D. Holcomb, P. Elzer, J. Estep, Q. Perry, S. Hagius, and C. Kirk. 2010. *Brucella* species survey in polar bears (*Ursus maritimus*) of Northern Alaska. *Journal of Wildlife Diseases* 46:687-694.
- Oritsland, N. A., F. R. Engelhardt, F. A. Juck, R. A. Hurst, and P. D. Watts. 1981. Effect of Crude Oil on Polar Bears. Environmental Studies Report No. 24. Northern Affairs Program, Department of Indian Affairs and Northern Development, Ottawa, ON.
- Pagano, A. M., G. M. Durner, S. C. Amstrup, K. S. Simac, and G. S. York. 2012. Long-distance swimming by polar bears (*Ursus maritimus*) of the southern Beaufort Sea during years of extensive open water. *Canadian Journal of Zoology* 90:663-676.
- Philippa, J. D. W., F. A. Leighton, P. Y. Daoust, O. Nielsen, M. Pagliarulo, H. Schwantje, T. Shury, R. Van Herwijnen, B. E. E. Martina, I. Kuiken, M. W. G. Van De Bildt, and A. Osterhaus. 2004. Antibodies to selected pathogens in free-ranging terrestrial carnivores and marine mammals in Canada. *Veterinary Record* 155:135-140.
- Polar Bear Management Agreement for the North Beaufort Sea and Viscount-Melville Sound Polar Bear Populations between the Inuit of the Kitikmeot West Region in Nunavut and the Inuvialuit. 2006. Available online: <http://jointsecretariat.ca/wp-content/uploads/2015/11/KitikmeotInuvialuitPBAgreemen20Feb2006.pdf> [Accessed June 2, 2016].
- Polar Bear Range States. 2015. Circumpolar Action Plan: Conservation Strategy for Polar Bears. A product of the representatives of the parties to the 1973 Agreement on the Conservation of Polar Bears. Available

- online: http://naalakkersuisut.gl/~media/Nanoq/Files/Attached%20Files/Fiskeri_Fangst_Landbrug/Polarbear%202015/CAP/CAP%20Book.pdf [Accessed June 2, 2016].
- Polar Bear Technical Committee (PBTC). 2015. Status Table 2015. Approved by the Polar Bear Administrative Committee.
- Rah, H., B. B. Chomel, E. H. Follmann, R. W. Kasten, C. H. Hew, T. B. Farver, G. W. Garner, and S. C. Amstrup. 2005. Serosurvey of selected zoonotic agents in polar bears (*Ursus maritimus*). *Veterinary Record* 156:7-13.
- Reidlinger, D. 2001. Community-based assessments of change: Contributions of Inuvialuit Knowledge to Understanding Climate Change in the Canadian Arctic. M.Sc. dissertation. National Resource Institute, University of Manitoba, Winnipeg, MB. 139 pp.
- Regehr, E. V., C. M. Hunter, H. Caswell, S. C. Amstrup, and I. Stirling. 2010. Survival and breeding of polar bears in the southern Beaufort Sea in relation to sea ice. *Journal of Animal Ecology* 79:117-127.
- Regehr, E. V., S. C. Amstrup, and I. Stirling. 2007. Polar Bear Population Status in the Southern Beaufort Sea. U.S. Geological Survey Open-File Report 2006-1337. 20 pp.
- Regehr, E. V., R. R. Wilson, K. D. Rode, and M. C. Runge. 2015. Resilience and risk – A demographic model to inform conservation planning for polar bears. U.S. Geological Survey Open-File Report 2105-1029. 56 pp. Available online: <http://dx.doi.org/10.3133/ofr20151029>.
- Rode, K. D., S. C. Amstrup, and E. V. Regehr. 2010. Reduced body size and cub recruitment in polar bears associated with sea ice decline. *Ecological Applications* 20:768-782.
- Rode, K. D., E. V. Regehr, D. C. Douglas, G. Durner, A. E. Derocher, G. W. Thiemann, and S. M. Budge. 2014a. Variation in the response of an Arctic top predator experiencing habitat loss: feeding and reproductive ecology of two polar bear populations. *Global Change Biology* 20:76-88.
- Rode, K. D., A. M. Pagano, J. F. Bromaghin, T. C. Atwood, G. M. Durner, K. S. Simac and S. C. Amstrup. 2014b. Effects of capturing and collaring on polar bears: findings from long-term research on the southern Beaufort Sea population. *Wildlife Research* 41:311-322.
- Rodgers, L. L. and S. M. Rodgers. 1977. Parasites of bears: a review. *Bear Research and Management* 3:411-430.
- Serreze, M. C., M. M. Holland, and J. Stroeve. 2007. Perspectives on the Arctic's shrinking sea-ice cover. *Science* 315:1533-1536.
- Sonne, C. 2010. Health effects from long-range transported contaminants in Arctic top predators: An integrated review based on studies of polar bears and relevant model species. *Environment International* 36:461-491.

Species at Risk Act (S.C. 2002, c. 29). Available online: <http://laws-lois.justice.gc.ca/PDF/S-15.3.pdf> [Accessed: June 2, 2016].

Species at Risk (NWT) Act. S.N.W.T. 2009,c.16. Available online: <https://www.justice.gov.nt.ca/en/files/legislation/species-at-risk/species-at-risk.a.pdf?v9234> [Accessed: June 2, 2016].

Species at Risk Committee (SARC). 2012. Species Status Report for Polar Bear (*Ursus maritimus*) in the Northwest Territories. Species at Risk Committee, Yellowknife, NT. xxii + 153 pp. Available online: <http://www.nwtspeciesatrisk.ca/species/polar-bear>.

St. Aubin, D. J. 1990. Physiologic and toxic effects on polar bears. Pages 235-239 in: J. R. Geraci and D. J. St Aubin, editors. *Sea Mammals and Oil: Confronting the Risks*. Academic Press, Inc. New York, NY.

Stirling, I., T. L. McDonald, E. S. Richardson, E. V. Regehr, and S. C. Amstrup. 2011. Polar bear population status in the Northern Beaufort Sea, Canada, 1971-2006. *Ecological Applications* 21:859-876.

Stirling, I., T. L. McDonald, E. S. Richardson, and E. V. Regehr. 2007. Polar bear population status in the northern Beaufort Sea. U. S. Geological Survey Administrative Report. U.S. Geological Survey, Reston, VA. iv + 33 pp.

Stockholm Convention on Persistent Organic Pollutants. 2004. Available online: http://www.pops.int/documents/convtext/convtext_en.pdf [Accessed October 3, 2016].

Taylor, M., B. Elkin, N. Maier, and M. Bradley. 1991. Observation of a polar bear with rabies. *Journal of Wildlife Diseases* 27:337-339.

Taylor, M. K., J. Laake, D. Cluff, M. Ramsay, and F. Messier. 2002. Managing the risk from hunting for the Viscount Melville Sound polar bear population. *Ursus* 13:185-202.

Thiemann, G. W., A. E. Derocher, S. G. Cherry, N. J. Lunn, E. Peacock, and V. Sahanatien. 2013. Effects of chemical immobilization on the movement rates of free-ranging polar bears. *Journal of Mammalogy* 94:386-397.

Thiemann, G. W., S. J. Iverson, and I. Stirling. 2008. Polar bear diets and Arctic marine food webs: insights from fatty acid analysis. *Ecological Monographs* 78:591-613.

U.S. Department of Interior, Minerals Management Service (DoIMMS). 2002. Liberty Development and Production Plan Final Environmental Impact Statement. OCS EIS/EA MMS 2002-020.

USFWS. 2010. Designation of critical habitat for the polar bear (*Ursus maritimus*) in the United States; Final Rule. *Federal Register* 75:76086-76137.

- USFWS. 2015. Polar Bear (*Ursus maritimus*) Conservation Management Plan Draft. U.S. Fish and Wildlife, Region 7, Anchorage, AK. 59 pp.
- Vongraven, D., J. Aars, S. Amstrup, S. N. Atkinson, S. Belikov, E. W. Born, T. D. DeBruyn, A. E. Derocher, G. Durner, M. Gill, N. Lunn, M. E. Obbard, J. Omelak, N. Ovshyanikov, E. Peacock, E. Richardson, V. Sahanatian, I. Stirling, and Ø. Wiig. 2012. A circumpolar monitoring framework for polar bears. *Ursus* 23:1-66.
- Whiteman, J. P., H. J. Harlow, G. M. Durner, R. Anderson-Sprecher, S. E. Albeke, E. V. Regehr, S. C. Amstrup, and M. Ben-David. 2015. Summer declines in activity and body temperature offer polar bears limited energy savings. *Science* 349:295-298.
- Wilson, K. J., J. Falkingham, H. Melling and R. De Abreu. 2004. Shipping in the Canadian Arctic. Canadian Ice Service, Ottawa, ON.
- Wildlife Act*. S.N.W.T. 2013,c.30. Available online: <https://www.justice.gov.nt.ca/en/files/legislation/wildlife/wildlife.a.pdf> [Accessed: June 2, 2016].
- Wildlife Act*. RSY 2002, c. 229. Available online: http://www.gov.yk.ca/legislation/acts/wildlife_c.pdf [Accessed: June 2, 2016].
- WMAC (NS). 2008. Factsheet: Harvesting Rights on the North Slope. Available online: http://www.wmacns.ca/pdfs/210_HarvestingRights-web.pdf [Accessed February 18, 2016].
- WMAC (NWT). 25 July 2011. Letter to ENR Minister re: Recommendations for northern Beaufort Sea polar bear population boundary change and Total Allowable Harvest. Inuvik, NT.
- Yukon Environmental and Socioeconomic Assessment Act*. S.C. 2003, c. 7. Available online: <http://laws-lois.justice.gc.ca/PDF/Y-2.2.pdf> [Accessed: June 2, 2016].

Appendix A: Additional Traditional Knowledge about ISR Polar Bear

The following information is from: *Joint Secretariat. 2015. Inuvialuit and Nanuq: A Polar Bear Traditional Knowledge Study. Joint Secretariat, Inuvialuit Settlement Region. xx + 304 pp.*

Inuvialuit have been hunting polar bears — nanuq — in Canada’s Western Arctic for generations and for as long as memory serves. Sharing of information, knowledge and understanding of nanuq from one generation to the next, based on experience, is the very foundation of Inuvialuit traditional knowledge. Inuvialuit hunters have witnessed changes firsthand — some slow, others rapid — to the same environmental conditions that they share with polar bears and with seals, an important prey species of polar bears. Especially since the 1980s, Inuvialuit have seen changes in climate, weather, sea state, sea ice and snow. Inuvialuit hunters have experienced directly, and learned from one another, how polar bears, seals and other wildlife have responded to these changes, just as Inuvialuit hunters themselves have responded to these changes. (p xi)

Observing and harvesting animals creates an intimate knowledge of the land, sea and ice. (p xii)

Everything from polar bear condition to mating, reproduction and polar bear harvest of seals, to Inuvialuit harvest of polar bears depends on ice conditions. There has always been significant annual variation in sea ice conditions and hence in local abundance, distribution and condition of polar bears and their primary prey. As a result, caution is required when thinking about the effects of climate change on polar bears. Inuvialuit recognize that there have been substantial changes in Beaufort Sea ice conditions since the mid-1980s that have affected their harvesting activities and opportunities to know and learn from polar bears. Changing ice conditions and a warming Arctic in general are a great concern to the Inuvialuit TKHs [traditional knowledge holders] who participated in [the Inuvialuit polar bear traditional knowledge study]. (p 212)

Polar bears and climate change

In general, TK holders said that the physical condition of polar bears in their areas has remained stable over time, although there is considerable variation from one season to the next, and even within a given hunting season. There appear to be fewer really big bears and they are not as fat as they were prior to the mid-1980s. (p 180)

Ice and seal hunting conditions are important, but are not the only factors determining where polar bears hunt. The consensus of the workshop participants is that it is premature to conclude that the abundance of polar bears in the Beaufort Sea has declined and that their overall condition has permanently deteriorated, given the complex nature of polar bear interactions with sea ice and seals. The number of polar bears in the Inuvialuit polar bear hunting area (generally the Canadian Beaufort Sea region) has remained relatively stable during the living memory of study participants. While TKHs stated repeatedly that ice conditions are changing, they also stated with equal vigor that ice conditions have always been highly variable. (p 212)

The following information is from the traditional knowledge section of: Species at Risk Committee. 2012. Species Status Report for Polar Bear (*Ursus maritimus*) in the Northwest Territories. Species at Risk Committee, Yellowknife, NT. xxii + 153 pp.

Polar bear numbers do go up and down in certain areas. When numbers fluctuate, it is hard to tell whether there are fewer bears overall or if they have just gone somewhere else. This is because polar bear movements cause numbers in certain areas to fluctuate. (p xvi)

Appendix B: Background Information on Subpopulation Status Assessments and History of Harvest Management

Southern Beaufort Sea/Northern Beaufort Sea Boundary Change

The previous boundary between the Southern Beaufort Sea (SB) and Northern Beaufort Sea (NB) polar bear subpopulation existed at approximately 125°W longitude, near Pearce Point, NWT (Brower et al. 2002). Radio telemetry studies suggest that this boundary did not reflect the space use patterns of bears in the eastern portion of the southern Beaufort Sea (Amstrup et al. 2005). More specifically, records indicate that approximately 90% of the bears harvested near Baillie Islands were actually NB bears (Amstrup et al. 2005).

In consideration of the apparent misallocation of NB bears to the SB harvest, the WMAC (NWT) and IGC consulted regarding the potential to change the SB/NB boundary. As a result, in 2013/14, the boundary was moved west to 133°W longitude, near the community of Tuktoyaktuk, NWT. The proportional representation of NB versus SB bears reduces to approximately 50:50 at this longitude, thus allowing harvest to be more accurately allocated between the subpopulations.

Due to the need to inform management decisions, an analysis was undertaken to estimate the subpopulations under the new boundary (Griswold et al. unpublished). The SB and NB capture data were repartitioned to reflect the shifted boundary. The SB re-analysis was based on the 2001-2006 capture data that were originally analyzed in Regehr et al. (2006). The models fitted for the SB re-analysis were nearly identical to those fitted in Regehr et al. (2006). The NB re-analysis was based on the 1971-2006 capture data and a suite of capture models identical to those analyzed in Stirling et al. (2011).

The re-analysis indicated that moving the boundary would correspond to reduction in the SB subpopulation size by 366 bears and an increase in the NB subpopulation of 255 bears. The mean of the number of bears moved from the SB to NB is 311, which is being used until another subpopulation estimate is available.

Southern Beaufort Sea Subpopulation

As noted above, the Southern Beaufort Sea (SB) subpopulation, as currently recognized in Canada, extends from 133°W at approximately Tuktoyaktuk, west to Icy Cape, Alaska.

The SB subpopulation is shared with Alaska and managed under the 1988 Inuvialuit-Inupiat agreement. The quota is recommended under the principles of this agreement by the designated commissioners of the North Slope Borough and the Inuvialuit Game Council, and technical advisors.

Management objectives and guiding principles for the Southern Beaufort polar bear subpopulation are outlined in the *Inuvialuit-Inupiat Polar Bear Management Agreement in the Southern Beaufort Sea*.

The leading objectives of this agreement are:

- *To maintain a healthy viable population of polar bears in the southern Beaufort Sea in perpetuity, and*
- *To manage polar bears on a sustained yield basis in accordance with all the best information available whereby the acceptable annual harvest level does not exceed net annual recruitment to the population and accounts for all forms of removal from the population*

The management partners and collaborating agencies for the SB subpopulation on the Canadian side are the Government of the Northwest Territories, the Yukon Government, the WMACs, the IGC, and Environment and Climate Change Canada.

The SB population declined substantially as harvest increased in the late 1950s/early 1960s due to sport hunting by non-aboriginals and fur price increases (Usher 1976, Amstrup et al. 1986, Amstrup 1995).

Quotas were first applied in Canada for the 1967-68 hunting season. In the absence of data, quotas for each settlement were established by averaging the harvest of the previous 3 years and then reducing that number by a modest amount (Brower et al. 2002).

The first quota increases based on scientific information were made in 1978-79 after completion of the first population study of polar bears in the Western Arctic (Stirling et al. 1975).

There have been multiple inventories conducted in the Southern Beaufort region, and all were based upon the former subpopulation boundaries. Results are summarized below:

Inventory period	Population Estimate	Confidence\Comments	Reference
1972-83	1,778	SD +803; CV=0.45	Amstrup et al. 1986
1992	Near 1,480		Amstrup 1995
1986-98	2,272 (2001)	Based on estimate of 1,250 females (C.V.=0.106); 55% females	Amstrup et al. 2001
2001-2006	1,526	95% CI=1211-1841; C.V.=0.106	Regehr et al. 2006

The current SB subpopulation estimate and estimate used for management is 1,215. This estimate is based on the Regehr et al. (2006) estimate (1,526) for the previous subpopulation area adjusted for new boundary at 133°W (Tuktoyaktuk) following unpublished analysis by Griswold et al in 2009, which indicated 311 bears would shift from the SB to the NB under the aforementioned boundary shift.

A recent population trend analysis by Bromaghin et al (2015), suggests that a decline occurred in the SB in the mid-2000s, coinciding with years of heavy sea ice conditions. The trend analysis suggests the population began to increase again towards the later 2000's. The study area and sampling regime on the Canadian side of the study area varied and introduced bias. It is difficult to assess the impact of this on the trend analysis. Plans are underway to conduct a new population estimate in 2017.

According to the PBTC in 2015, the *local and or TK assessment* of SB was 'stable'. The *recent trend* (15 years ago to present) was identified as 'likely decline' because the population estimate resulting from joint work across borders (2003-2006) produced a population estimate that was lower but not statistically different from the previous population estimate (Amstrup et al. 1986, Regehr et al. 2006). The *future trend* (present to 10 years into future) was also identified as 'likely decline' based on sea ice declines (Durner et al. 2009), changes in body size and cub recruitment of SB bears in Alaska (Rode et al. 2010), and modeling that suggests declines in survival and breeding rates are related to increases in the ice free period (Regehr et al. 2010).

Northern Beaufort Sea Subpopulation

The Northern Beaufort Sea (NB) subpopulation as currently recognized in Canada extends from Tuktoyaktuk (133° W) east through Amundsen Gulf and Dolphin and Union Strait to include Coronation Gulf. It covers nearly all of the Northern Beaufort Sea and into M'Clure Strait. This includes portions of Nunavut.

As noted earlier in Appendix B, the subpopulation boundary between the NB/SB changed in 2013/14 from its previous location at approximately Pearce Point to Tuktoyaktuk (133° W); the NWT management unit has been adjusted accordingly.

Management objectives and guiding principles for the NB are outlined in the *Polar Bear Management Agreement for the North[ern] Beaufort Sea and Viscount Melville Sound Polar Bear Populations between Inuit of the Kitikmeot West Region in Nunavut and the Inuvialuit (2006)*.

The leading objectives of this agreement are:

- *To maintain the North Beaufort Sea and Viscount-Melville Sound polar bear populations at healthy viable levels in perpetuity, and*
- *To manage polar bears on a sustained yield basis in accordance with all the best information available*

Where:

Sustainable yield means a harvest level which does not exceed net annual recruitment to the population and accounts for all human-caused forms of removal from the population and which considers the status of the population, based on the best available scientific information and Traditional Knowledge/Inuit Qaujimajatuqangit;

And noting that the continued hunting of polar bears is essential to maintain the dietary, cultural, and economic base of the groups;

And noting that the maintenance of a sustained harvest for traditional users in perpetuity requires that the number of polar bears taken annually not exceed the productivity of the population.

The management partners and collaborating agencies for the NB subpopulation on the ISR side are the Government of the Northwest Territories, the WMAC (NWT), the IGC, and Environment and Climate Change Canada.

There have been multiple population assessments conducted in the NB, and all were based upon the former subpopulation boundaries. Inventory periods and resultant population estimates during each decade are as follows (as documented in Stirling et al. (2007) except final 2006 estimate):

Table 5. Population estimates for Northern Beaufort Sea subpopulation

Inventory Period	Population Estimate	95% Confidence Interval	Estimate for Management Purposes	Comments
1972-1975	745	± 246	1,200	
1985-1987	867	± 141	1,200	
1992-1994	289	± 62	1,200	Only area north of Norway Island covered consistently
2004-2006	980	± 155	1,400	Increase in estimate based on negative bias due lack of capture effort in north and east portions of study area
2006	1,291		1,711	Boundary change moves estimated 311 bears based on analysis in 2009 (Griswold et al. unpublished) and estimate used for management purposes adjusted for bias in sampling

Stirling et al. (2007) indicate that estimate of bears during the 1990s was lower; however, capture effort for this period differed from other periods, and was focused in the northern portion of the subpopulation (northwest corner of Banks Island and Prince Patrick Island).

The NB population estimate under the current boundary is 1,291, a number derived from the 2000s estimate with the addition of 311 bears (following analysis in 2009 (Griswold et al. unpublished) that estimated the number of bears that would shift between subpopulations under the boundary change.

Stirling et al. (2011) recognized that the estimate from the 2000s (980) was likely biased low (possibly related to changes in distribution), and suggested the population estimates of 1200-1300 in 2004 and 2005 may more accurately reflect the current number of bears in the population. They furthermore, recognized that limited sampling in the northern portion of the study area may have led to estimates that are biased low.

The NB population estimate used for management purposes has historically and continues to be adjusted to reflect negative bias. The current estimate used for management purposes of the NB is 1,710 (WMAC (NWT) 25 July 2011).

Hunting in the NB has historically been focused in the Amundsen Gulf and western coast of Banks Island (with a focus near Sachs Harbour) (Usher 1976).

Within Canada, quotas were first established in NWT by the 33rd Session of the Territorial Council at Resolute Bay. The quotas were to become effective on July 1 for the 1967-68 hunting season. In the absence of data, quotas for each settlement were established by averaging the harvest of the previous 3 years and then reducing that number by a modest amount.

The first quota increases based on scientific information were made in 1978-79 after completion of the first population study of polar bears in the Western Arctic (Stirling 1975).

According to the PBTC in 2015, the *local and or TK assessment* of NB was ‘stable’, and the *recent trend* (15 years ago to present) was identified as ‘likely stable’. The *future trend* (present to 10 years into future) was also identified as ‘likely stable’ based on information suggesting that the NB has remained stable, and habitat conditions may improve in the short term (Durner et al. 2009; Stirling et al. 2011; Joint Secretariat 2015). Plans are underway to conduct a new population estimate in 2017.

Viscount Melville Sound Subpopulation

The Viscount Melville Sound subpopulation (VM) extends from northern Victoria Island through the Viscount-Melville Sound to north of Melville Island, and from eastern M’Clure Strait, north to eastern Prince Patrick Island (Figure 4). The majority of the subpopulation area is within the ISR, with the eastern portion within Nunavut.

Management objectives and guiding principles for the NB are outlined in the *Polar Bear Management Agreement for the North[ern] Beaufort Sea and Viscount Melville Sound Polar Bear Populations between Inuit of the Kitikmeot West Region in Nunavut and the Inuvialuit* (2006).

The key objectives of this agreement are:

- *To maintain the North Beaufort Sea and Viscount-Melville Sound polar bear populations at healthy viable levels in perpetuity, and*
- *To manage polar bears on a sustained yield basis in accordance with all the best information available*

Where:

Sustainable yield means a harvest level which does not exceed net annual recruitment to the population and accounts for all human-caused forms of removal from the population and which considers the status of the population, based on the best available scientific information and Traditional Knowledge/Inuit Qaujimajatuqangit

And noting that the continued hunting of polar bears is essential to maintain the dietary, cultural, and economic base of the groups;

And noting that the maintenance of a sustained harvest for traditional users in perpetuity requires that the number of polar bears taken annually not exceed the productivity of the population;

The management partners and collaborating agencies for the VM subpopulation on the ISR side are the Government of the Northwest Territories, the WMAC (NWT), the IGC and Environment and Climate Change Canada.

The first subpopulation inventory for VM was conducted between 1989 and 1992 and yielded an estimate of 161 bears (SE = 34) (Taylor et al 2002). There had been previous work (1974-1976) in the southern portion of the subpopulation area (Hadley Bay and Wynniatt Bay) as part of a broader study; however, no specific VM estimate was produced (Schweinsburg et al. 1981). Following fieldwork from 1989-1992, there was a concern that relatively high harvest rates and strong selection for males that occurred prior to the inventory had reduced the number of adult males in the population impacting productivity. As a result, beginning in 1994, there was a 5 year moratorium on harvest of VM bears. A subsequent simulation analysis using RISKMAN suggested that in 1999 (following a 5 year moratorium) there was an estimated population of 215 (SE = 57.4) (Taylor et al. 2002). A subpopulation estimate for the VM is currently underway (fieldwork conducted 2012-2014).

Within Canada, quotas were first established in NWT by the 33rd Session of the Territorial Council at Resolute Bay. The quotas were to become effective on July 1 for the 1967-68 hunting season. In the absence of data, quotas for each settlement were established by averaging the harvest of the previous 3 years and then reducing that number by a modest amount.

In 1973-74, the GNWT created a quota of 12 bears for Melville Island and 4 for Hadley Bay on northeast Victoria Island. Arguments (excerpts from PBTC minutes) supporting the establishment of this quota were: a) that it would be an added incentive for people to travel further from the settlements, particularly in years of fox abundance; b) a limited kill would allow accumulation of some information about the bear population in the area, which was currently lacking and, c) the kill would not cause irreparable damage and might give incentive for biological research in the area. At the time the PBTC suggested that the harvest should be

monitored, along with full collection of specimens, and subject to review in due course when research has been conducted in the area.

Initially, the Hadley Bay quota was to be taken by hunters from Cambridge Bay. In 1980-81, the Hadley Bay quota was increased to 8. After the signing of the IFA (1984), Ulukhaktok began taking up to 8 of their community quota in Wynniatt Bay.

Although the Melville quota was hunted most often by Sachs Harbour and Ulukhaktok, it was also allocated to hunters from Resolute and other areas in the eastern Arctic.

In 1984, the Melville quota was permanently assigned to be shared between Sachs Harbour and Ulukhaktok.

Beginning in the 1991-92 season, the quotas for Hadley Bay and Melville Island (8 and 12 respectively) were eliminated. Instead, Sachs Harbour, Ulukhaktok, and Cambridge Bay received an additional 6 tags each. The six bear allocations to Ulukhaktok and Cambridge Bay were still allowed to be taken from Viscount-Melville Sound for 1991/92 and 1992/93. The bears taken by Cambridge Bay were mostly from northeastern Victoria Island.

It was stipulated that the 6 bears allocated to Sachs Harbour would be for males and taken north of Norway Island (within the Northern Beaufort subpopulation).

In the negotiations for a management agreement for Viscount Melville Sound, the management area was adjusted and a quota of 4 was settled upon. Ulukhaktok was allocated a quota of 4 for Viscount Melville Sound in 1993-94. Beginning in the 1994-95 hunting season, a five year moratorium on hunting polar bears in Viscount Melville Sound took effect. After that, a rotation took place between Cambridge Bay and Ulukhaktok (formerly Holman), in alternate years, for a quota of 4 bears. Since Ulukhaktok had the last quota from Viscount Melville, the new rotation was scheduled to begin with Cambridge in 1999-2000. Commencing in 2004/2005 the quota for Ulukhaktok and Cambridge Bay was set at 4 and 3 bears respectively.

According to the PBTC 2015 Status table, the *local and or TK assessment* of VM was ‘increased’. This was based on information from the Canadian Wildlife Service Nunavut consultation meetings in 2009 (CWS unpublished), and information from community consultations in Cambridge Bay and Ulukhaktok during 2012 and 2013 (ENR unpublished meeting notes). The *recent trend* (15 years ago to present) was identified as ‘likely stable’ because the harvest has been managed for population growth since the 1989-1992 survey which included a 5 year moratorium. The *future trend* (present to 10 years into future) was identified as ‘uncertain’ because vital rates used in the population viability analysis (RISKMAN) are 22 years old, and a population reassessment is currently in progress.

Arctic Basin Subpopulations

ISR management authorities share responsibility for managing the Arctic Basin subpopulation with all signatories to the 1973 Polar Bear Range States Agreement. There is no harvest of Arctic Basin bears, and no population estimate has ever been produced. At the 2015 Range States meeting, the Polar Bear Specialist Group was asked to develop a recommendation about what

kind of survey or surveys would be appropriate for this population, and to provide a cost estimate.

References:

- Amstrup, S. C. 1995. Movements, distribution, and population dynamics of polar bears in the Beaufort Sea. Ph.D. Dissertation. University of Alaska-Fairbanks, Fairbanks, AK. 299 pp.
- Amstrup, S. C., G. M. Durner, I. Stirling, and T. L. McDonald. 2005. Allocating harvests among polar bear stocks in the Beaufort Sea. *Arctic* 58(3):247-259.
- Amstrup, S. C., T. L. McDonald, and I. Stirling. 2001b. Polar bears in the Beaufort Sea: A 30-year mark-recapture case history. *Journal of Agricultural, Biological, and Environmental Statistics* 6(2):221-234.
- Amstrup, S. C., I. Stirling, and J. W. Lentfer. 1986. Past and present status of polar bears in Alaska. *Wildlife Society Bulletin* 14:241-254.
- Amstrup, S. C., I. Stirling, T. S. Smith, C. Perham, and G. W. Thiemann. 2006. Recent observations of intraspecific predation and cannibalism among polar bears in the southern Beaufort Sea. *Polar Biology* 29:997-1002.
- Bromaghin, J. F., T. L. McDonald, I. Stirling, A. E. Derocher, E. S. Richardson, E. V. Regehr, D. C. Douglas, G. M. Durner, T. C. Atwood, and S. C. Amstrup. 2015. Polar bear population dynamics in the southern Beaufort Sea during a period of sea ice decline. *Ecological Applications* 25(3):634-651.
- Brower, C. D., A. Carpenter, M. L. Branigan, W. Calvert, T. Evans, A. S. Fischbach, J. A. Nagy, S. Schliebe, and I. Stirling. 2002. The Polar Bear Management Agreement for the Southern Beaufort Sea: An evaluation of the first ten years of a unique conservation agreement. *Arctic* 55(4):362-372.
- Canadian Wildlife Service. Unpublished. Nunavut Consultation Report: Consultations on the Proposed Listing of the Polar Bear as Special Concern under the Species at Risk Act. Conducted February—April 2009.
- COSEWIC. 2008. COSEWIC assessment and update status report on the polar bear *Ursus maritimus* in Canada. Committee on the Status of Endangered Wildlife in Canada, Ottawa, ON. vii + 75 pp.
- Durner, G. M., D. C. Douglas, R. M. Nielson, S. C. Amstrup, T. L. McDonald, I. Stirling, M. Mauritzen, E. W. Born, Ø. Wiig, E. DeWeaver, M. C. Serreze, S. E. Belikov, M. M. Holland, J. Maslanik, J. Aars, D. C. Bailey, and A. E. Derocher. 2009. Predicting 21st century polar bear habitat distribution from global climate models. *Ecological Monographs* 79(1):25-58.

- Griswold J., T. McDonald, M. Branigan, E. V. Regehr, and S. C. Amstrup. Unpublished. Southern and northern Beaufort Sea polar bear population estimates under a proposed boundary shift. Draft Manuscript Report.
- Joint Secretariat. 2015. Inuvialuit and Nanuq: A Polar Bear Traditional Knowledge Study. Joint Secretariat, Inuvialuit Settlement Region. xx + 304 pp. Available online: http://www.wmacns.ca/pdfs/394_polar-bear-tk-report-low-res.pdf.
- Regehr, E. V., S. C. Amstrup, and I. Stirling. 2006. Polar bear population status in the southern Beaufort Sea. U.S. Geological Survey Open File Report 2006-1337. 20 pp.
- Regehr, E. V., C. M. Hunter, H. Caswell, S. C. Amstrup, and I. Stirling. 2010. Survival and breeding of polar bears in the southern Beaufort Sea in relation to sea ice. *Journal of Animal Ecology* 79:117-127.
- Rode, K. D., S. C. Amstrup, and E. V. Regehr. 2010. Reduced body size and cub recruitment in polar bears associated with sea ice decline. *Ecological Applications* 20:768–782.
- Schweinsburg, R. E., D. J. Furnell, and S. J. Miller. 1981. Abundance, distribution, and population structure of polar bears in the lower Central Arctic Islands. Wildlife Service Completion Report Number 2 . Government of the Northwest Territories, Yellowknife, NT.
- Species at Risk Committee. 2012. Species Status Report for Polar Bear (*Ursus maritimus*) in the Northwest Territories. Species at Risk Committee, Yellowknife, NT. xxii + 153 pp. Available online: http://www.nwtspeciesatrisk.ca/sites/default/files/polar_bear_nwt_status_report_dec_2012_0.pdf.
- Stirling, I., D. Andriashek, P. Latour, and W. Calvert. 1975. The distribution and abundance of polar bears in the eastern Beaufort Sea. Final Report to the Beaufort Sea Project. Fisheries and Marine Service, Department of Environment, Victoria, B.C. 59 pp.
- Stirling, I., T. L. McDonald, E. S. Richardson, and E. V. Regehr. 2007. Polar Bear Population Status in the Northern Beaufort Sea. U.S. Geological Survey Administrative Report. U.S. Geological Survey, Reston, VA. iv + 33 pp.
- Stirling, I., T. L. McDonald, E. S. Richardson, E. V. Regehr, and S. C. Amstrup. 2011. Polar bear population status in the northern Beaufort Sea, Canada, 1971-2006. *Ecological Applications* 21:859-876.
- Taylor, M. K., J. Laake, H. D. Cluff, M. Ramsay, and F. O. Messier. 2002. Managing the risk from hunting for the Viscount Melville Sound polar bear population. *Ursus* 13:185-202.
- Usher, P. 1976. Inuit Land Use in the Western Canadian Arctic. Pp. 21-31 in: Inuit Land Use and Occupancy Report, Vol. 1. M. M. R. Freeman, ed. Department of Indian Affairs and Northern Development, Ottawa, ON.

WMAC (NWT). 25 July 2011. Letter to ENR Minister re: Recommendations for northern Beaufort Sea polar bear population boundary change and Total Allowable Harvest. Inuvik, NT.

Appendix C: Threats Classification Table by Polar Bear Subpopulation

A short description of each threat can be found in Section 4.6. A detailed threats classification was done to identify the overall level of concern for each threat by subpopulation. This threats classification was completed collaboratively by representatives of ENR, WMAC (NWT), WMAC (NS), IGC, Environment Yukon, Parks Canada, and Environment and Climate Change Canada in November 2015. Participants brought to the table information gathered by their respective organizations. Parameters used to classify threats are explained in Table C1. Results are presented below.

Table C1. Parameters used in threats classification.

Parameter	Description	Categories
Timing (i.e., immediacy)	Indicates if the threat is: Presently happening Expected over the life of the plan, i.e. 10 years Expected in > 10 years Not expected to happen	Happening now Short-term future Long-term future Not expected
Probability of event within 10 years	Indicates the likelihood of the threat to occur over the life of the plan, i.e. 10 years	High Medium Low
Extent (scope)	Indicates the spatial extent of the threat (based on percentage of subpopulation area affected)	Widespread (greater than 50%) Localized (less than 50%) Unknown
Severity of subpopulation- level effect	Indicates how severe the impact of the threat would be at a subpopulation level if it occurred	High Medium Low Unknown
Temporality	Indicates the frequency with which the threat occurs (i.e. all year round or only seasonally)	Seasonal Continuous
Causal Certainty:	Indicates the confidence in understanding the impact that the threat has on polar bears	High Medium Low
Overall level of Concern	Indicates the overall threat to sustainability of the subpopulation, over the life of the plan, i.e. 10 years (considering the above)	High Medium Low

Threat #1. Climate change (warming and ice reduction)	
Specific Threat	Lack of platform to hunt prey (temporal and spatial); change affecting availability of prey; separation from terrestrial denning areas and refugia; alteration of denning habitat
Stress	Increased nutritional stress; increased intraspecific competition; increased energy expenditure (increased distance to travel (swim/walk) to preferred habitat) and corresponding impacts on survival and recruitment; increased risk of drowning; thermal consequences (cubs swimming); denning failure (den collapse/inadequate den resulting in reproductive consequences)

Threat Information	Southern Beaufort	Northern Beaufort	Viscount Melville	Arctic Basin
Timing (i.e., immediacy) of threat: indicates if the threat is present (happening now); expected in the short term future (within 10 years); expected in the long term future (>10 years)	Happening now	Happening now	Short-term future	Long term future
Probability of event over the life of the plan, i.e. 10 years (high, medium, low)	High	High	Medium/Low	Low
Extent (scope): the spatial extent of the threat (widespread; localized)	Widespread	Localized	Localized	Unknown
Severity of subpopulation-level effect (high; medium, low)	High\Medium	Low	Low	Low
Temporality: frequency with which the threat occurs (seasonal/continuous)	Seasonal	Seasonal	Seasonal	Seasonal
Causal Certainty: level of certainty with which it is a threat to the species once it occurs (high, medium, low)	High	High	High	High
Overall level of concern regarding threat to sustainability of the subpopulation, over the life of the plan, i.e. 10 years, considering the above (high; medium, low)	High/medium	Low	Low	Low

Threat #2. Oil and Gas Development – Risk of large scale oil spill⁴	
Specific Threat	Oil contamination (fur); hydrocarbon ingestion (through prey/through self-cleaning); reduced prey availability
Stress	Toxic; lethal if ingested; nutritional stress

Threat Information	Southern Beaufort	Northern Beaufort	Viscount Melville	Arctic Basin
Timing (i.e., immediacy) of threat: indicates if the threat is present (happening now); expected in the short term future (within 10 years); expected in the long term future (>10 years)	Happening now (Alaska)	Long term future	Long term future	Unknown
Probability of event over the life of the plan, i.e. 10 years (high, medium low)	Low	Low	Low	Low
Extent (scope): the spatial extent of the threat (widespread; localized)	Widespread	Widespread	Widespread	Widespread
Severity of population-level effect (high; med; low)	High	High	High	High
Temporality frequency with which the threat occurs (seasonal/continuous)	Continuous	Continuous	Continuous	Continuous
Causal Certainty: level of certainty with which it is a threat to the species once it occurs (high, medium, low)	High	High	High	High
Overall level of concern regarding threat to sustainability of the subpopulation, over the life of the plan, i.e. 10 years, considering the above (high; medium, low)	Low	Low	Low	Low

⁴ Tier 2 and tier 3 spills – requiring national or international-level response

Threat #3. Increased shipping (could be related to oil and gas development, tourism, or related to an increase in shipping through Northwest Passage)	
Specific Threat	Alteration of habitat (influencing freeze-up); increased traffic; increased potential for contaminants to enter ecosystem (though spill or waste being released); change in quality of habitat; noise
Stress	Potential for a strike to occur (bears spending more time swimming – occurs during same season as shipping); unknown impact of exposure to increased contaminants; changes in behaviour and movements

Threat Information	Southern Beaufort	Northern Beaufort	Viscount Melville	Arctic Basin
Timing (i.e., immediacy) of threat: indicates if the threat is present (happening now); expected in the short term future (within 10 years); expected in the long term future (>10 years)	Happening now	Happening now	Short-term future	Long-term future
Probability of event over the life of the plan, i.e. 10 years (high, medium low)	High	High	Medium/Low	Low
Extent (scope): the spatial extent of the threat (widespread; localized)	Widespread	Localized	Localized	Localized
Severity of subpopulation-level effect (high; medium, low)	Low	Low	Low	Low
Temporality frequency with which the threat occurs (seasonal/continuous)	Seasonal	Seasonal	Seasonal	Seasonal
Causal Certainty: level of certainty with which it is a threat to the species once it occurs (high, medium, low)	Low	Low	Low	Low
Overall level of concern regarding threat to sustainability of the subpopulation, over the life of the plan, i.e. 10 years, considering the above (high; medium, low)	Medium/Low	Low	Low	Low

Threat #4. Human caused mortality in excess of TAH	
Specific Threat	Increase in potential for human-bear conflicts related to changing patterns of aggregation in response to changing habitat; increased potential for human habituation, DLPs and illegal harvest in areas where resource development occurs in or near sea ice habitat.
Stress	Mortality as a result from human-bear conflict where it exceeds the TAH when combined with harvest. There would also be impacts on subsistence harvest as an increase in DLPs would result in a decrease in potential subsistence harvests (as DLPs are counted under the quota). Potential for population level impact if TAH is exceeded repeatedly.

Threat Information	Southern Beaufort	Northern Beaufort	Viscount Melville	Arctic Basin
Timing (i.e., immediacy) of threat: indicates if the threat is present (happening now); expected in the short term future (within 10 years); expected in the long term future (>10 years)	Not expected	Not Expected	Not Expected	Not Expected
Probability of event over the life of the plan, i.e. 10 years (high, med; low)	Low	Low	Low	Low
Extent (scope): the spatial extent of the threat (widespread; localized)	Localized	Localized	Localized	Localized
Severity of subpopulation-level effect (high; med; low)	Low	Low	Low	Low
Temporality frequency with which the threat occurs (seasonal/continuous)	Seasonal	Seasonal	Seasonal	Seasonal
Causal Certainty: level of certainty with which it is a threat to species once it occurs (high, medium, low)	High	High	High	High
Overall level of concern regarding threat to subpopulation, over the life of the plan, i.e. 10 years, considering the above (high; med; low)	Low	Low	Low	Low

Threat #5. Pollution and contamination	
Specific Threat	Increased contaminants as a result of liberation related to climate change; increased contaminant levels (including POPs, mercury) related to resource extraction, shipping, and other industrial activities worldwide; ingestion of garbage; increased pollution
Stress	Increased contaminants can impact heath function; can change prey availability

Threat Information	Southern Beaufort	Northern Beaufort	Viscount Melville	Arctic Basin
Timing (i.e., immediacy) of threat: indicates if the threat is present (happening now); expected in the short term future (within 10 years); expected in the long term future (>10 years)	Happening now	Happening now	Happening now	Happening now
Probability of event over the life of the plan, i.e. 10 years (high, med; low)	High	High	High	High
Extent (scope): the spatial extent of the threat (widespread; localized)	Widespread/ localized	Widespread/ localized	Widespread/ localized	Widespread/ localized
Severity of population-level effect (high; medium; low)	Unknown	Unknown	Unknown	Unknown
Temporality frequency with which the threat occurs (seasonal/continuous)	Continuous	Continuous	Continuous	Continuous
Causal Certainty: level of certainty with which it is a threat to the species once it occurs (high, medium, low)	Medium	Medium	Medium	Medium
Overall level of concern regarding threat to subpopulation, over the life of the plan, i.e. 10 years, considering the above (high; medium; low)	Medium	Medium	Medium	Medium

Threat #6. Research impacts	
Specific Threat	Impact of capture (immobilization event); impact of devices (collars, implants) on individual bears; aircraft disturbance – viewed cumulatively
Stress	Cub survival; nutritional consequence if feeding activity hindered); immune impairment due to capture, handling, and device application (eg. collar damage, implants); potential for the spread of disease and parasites (through ineffective sterilization of equipment)

Threat Information	Southern Beaufort	Northern Beaufort	Viscount Melville	Arctic Basin
Timing (i.e., immediacy) of threat: indicates if the threat is present (happening now); expected in the short term future (within 10 years); expected in the long term future (>10 years)	Happening now	Happening now	Long term future	Long-term future
Probability of event over the life of the plan, i.e. 10 years (high, med; low)	High	High	Low	Low
Extent (scope): the spatial extent of the threat (widespread; localized)	Widespread	Widespread	Widespread	Unknown
Severity of population-level effect (high; medium; low)	Low	Low	Low	Low
Temporality frequency with which the threat occurs (seasonal/continuous)	Continuous	Continuous	Continuous	Continuous
Causal Certainty: level of certainty with which it is a threat to the species once it occurs (high, medium, low)	Low	Low	Low	Low
Overall level of concern regarding threat to subpopulation, over the life of the plan, i.e. 10 years, considering the above (high; med; low)	Medium\Low	Low	Low	Low

Threat #7. Disease and parasites	
Specific Threat	Overall warming of the Arctic may result in the ability of non-native parasites and disease to arrive in region (possibly from species expanding their range north) and persist; nutritional stress may lead to consumption of internal organs of prey, thus potentially increasing exposure to parasites and pathogens (capture)
Stress	Remains to be determined; potential immune and nutritional consequences.

Threat Information	Southern Beaufort	Northern Beaufort	Viscount Melville	Arctic Basin
Timing (i.e., immediacy) of threat: indicates if the threat is present (happening now); expected in the short term future (within 10 years); expected in the long term future (>10 years)	Happening now	Short-term future	Unknown	Unknown
Probability of event over the life of the plan, i.e. 10 years (high, med; low)	High	Medium	Unknown	Unknown
Extent (scope): the spatial extent of the threat (widespread; localized)	Widespread	Unknown	Unknown	Unknown
Severity of subpopulation-level effect (high; med; low)	Unknown	Unknown	Unknown	Unknown
Temporality frequency with which the threat occurs (seasonal/continuous)	Continuous	Continuous	Continuous	Continuous
Causal Certainty: level of certainty with which it is a threat to the species once it occurs (high, medium, low)	Low	Low	Low	Low
Overall level of concern regarding threat to subpopulation, over the life of the plan, i.e. 10 years, considering the above (high; med; low)	Medium	Low	Low	Low

Threat #8. Competition	
Specific Threat	Grizzly bears expanding their range north could potentially lead to increased competition\conflict and hybridization
Stress	An increase in competition/conflict may result in nutritional stress, injury or mortality; an increase in hybridization events may decrease females available to mate in polar bear populations; potential change in genetic structure of subpopulation

Threat Information	Southern Beaufort	Northern Beaufort	Viscount Melville	Arctic Basin
Timing (i.e., immediacy) of threat: indicates if the threat is present (happening now); expected in the short term future (within 10 years); expected in the long term future (>10 years)	Happening now	Happening now	Happening now	Not expected
Probability of event over the life of the plan, i.e. 10 years (high, med; low)	High	High	High	Low
Extent (scope): the spatial extent of the threat (widespread; localized)	Localized	Localized	Localized	Not expected
Severity of population-level effect (high; med; low)	Low	Low	Low	Not expected
Temporality frequency with which the threat occurs (seasonal/continuous)	Seasonal	Seasonal	Seasonal	Not expected
Causal Certainty: level of certainty with which it is a threat to the species once it occurs (high, medium, low)	Low	Low	Low	Low
Overall level of concern regarding threat to subpopulation, over the life of the plan, i.e. 10 years, considering the above (high; med; low)	Low	Low	Low	Low

**Part 3 – *Nunavut Polar Bear Co-Management Plan*, prepared
by the Nunavut Polar Bear Co-Management Working Group**



NUNAVUT POLAR BEAR CO-MANAGEMENT PLAN

Government of Nunavut

NUNAVUT POLAR BEAR CO-MANAGEMENT PLAN

PREFACE

Management of polar bears (*Ursus maritimus*) in Canada is conducted at the territorial and provincial levels. Federal lands, such as Migratory Bird Sanctuaries, National Wildlife Areas and National Parks, are managed for conservation purposes and may include management measures for polar bears. In addition, there is recognition that management requires inter-jurisdictional coordination of efforts. In Nunavut, management of wildlife is governed by the *Nunavut Agreement*. The *Nunavut Agreement* recognizes Inuit harvesting rights and requires that Inuit play an effective role in all aspects of wildlife management. The management of polar bears shall acknowledge the best available scientific knowledge and Inuit Qaujimajatuqangit. The process for decision-making is clearly defined under the *Nunavut Agreement*.

The Nunavut Wildlife Management Board (NWMB) and Nunavut Minister of the Environment hold the primary and ultimate responsibility for wildlife management, respectively, under the *Nunavut Agreement*. The NWMB has the discretionary responsibility of approving management plans (*Nunavut Agreement*: Article 5 section 5.2.34 d(i)).

Successful management of polar bears depends on the commitment and cooperation of all co-management partners involved in implementing the directions set out in this management plan. The *Nunavut Polar Bear Co-Management Plan* has been prepared by the Government of Nunavut-Department of Environment (Department of Environment) in cooperation with Nunavut Tunngavik Inc. (NTI), Regional Wildlife Organizations (RWOs), Hunters and Trappers Organizations (HTOs), and Inuit community members from throughout Nunavut.

Implementation of this management plan is subject to appropriations, priorities, and budgetary constraints of the participating jurisdictions and organizations.

41 EXECUTIVE SUMMARY

42 This management plan has been developed cooperatively by co-management partners
43 to improve the existing polar bear management regime in Nunavut. It replaces the
44 Memoranda of Understanding (MOUs) that have directed management efforts to date.
45 These efforts have been instrumental in facilitating the recovery of polar bear
46 populations from the lows of the 1950s while maintaining traditional use by Inuit.

47 The Polar Bear was listed as a species of Special Concern under the federal *Species at*
48 *Risk Act* (SARA) in 2011. A Special Concern designation is used for species that may
49 become threatened or endangered because of a combination of biological
50 characteristics and identified threats. While there are no associated implications on Inuit
51 harvest or management actions, a management plan must be developed and published
52 on the *Species at Risk Public Registry* for all species of Special Concern.

53 This management plan may be adopted—in whole or part—as the Nunavut territorial
54 component of the national management plan under SARA while respecting the co-
55 management process legislated by the *Nunavut Agreement*.

56 The intent of this management plan is (1) to identify goals and objectives for polar bear
57 management; and (2) guide co-management partners in decision-making. Improved
58 communications, co-management partner participation, and cooperation will be
59 fundamental to the plan's success.

60 The previous management system relied heavily on scientific monitoring and modelling
61 to determine sustainable harvest rates. This scientific approach has been effective and
62 will continue, but the proposed *Nunavut Polar Bear Co-Management Plan* allows for full
63 participation of Inuit. Improved collection and use of Inuit Qaujimajatuqangit and
64 increased Inuit participation in all aspects of management are central to the goals of this
65 plan.

66
67
68
69
70
71
72
73
74
75
76

77	Table of Contents	
78	PREFACE	2
79	EXECUTIVE SUMMARY	3
80	ACKNOWLEDGEMENTS	7
81	1. INTRODUCTION.....	8
82	2. GUIDING PRINCIPLES	9
83	3. GOAL OF THE POLAR BEAR MANAGEMENT PLAN	10
84	4. SPECIES DESCRIPTION	10
85	4.1 Status:	10
86	4.2 General description	10
87	4.3 Distribution	11
88	4.3.1 Global range	11
89	4.3.2 Nunavut range.....	11
90	4.4 Biology	12
91	4.4.1 Life cycle and reproduction	12
92	4.4.2 Natural mortality and survival	13
93	4.4.3 Diet	13
94	4.4.4 Habitat	14
95	5. BACKGROUND ON POLAR BEAR MANAGEMENT	14
96	5.1 Historical perspective	14
97	5.2 The Nunavut perspective	14
98	5.3 Legislative frameworks and agreements.....	15
99	6. POLAR BEAR CO-MANAGEMENT IN NUNAVUT	16
100	6.1 Decision criteria.....	16
101	6.2 Principles of conservation.....	16
102	6.3 Co-Management partners.....	16
103	6.3.1 Nunavut Tunngavik Inc.	16
104	6.3.2 NWMB	17
105	6.3.3 RWOs	17
106	6.3.4 HTOs	17
107	6.3.5 Government of Nunavut	17
108	6.3.6 Government of Canada	17
109	7. CONSERVATION THREATS AND CHALLENGES	19
110	7.1 Threats	19
111	7.1.1 Sea-ice habitat loss and alteration due to climate change	19
112	7.1.2 Denning habitat alteration due to climate change	19
113	7.1.2 Industrial activity	20
114	7.1.3 Pollution/contaminants	20
115	7.1.4 Tourism.....	20

116	7.2 Challenges	21
117	7.2.1 Subpopulation boundaries.....	21
118	7.2.2 Polar bears and people	21
119	7.2.3 Inter-jurisdictional considerations	22
120	7.2.4 Trade.....	22
121	8. MANAGEMENT PLAN OBJECTIVES	23
122	8.1 Harvest management and objectives (Angujaujunnaqtunik Aulattiniq)	23
123	8.1.1 Harvest management	23
124	8.1.2 Selective harvesting.....	24
125	8.1.3 Harvest reporting and monitoring.....	25
126	8.1.4 Potential harvest management actions and scenarios.....	26
127	8.2 Information and knowledge gathering (<i>Qanuqtuurniq</i>) and objectives	26
128	8.2.1 Gaining knowledge	26
129	8.2.2 Research.....	27
130	8.3 Habitat management and environmental stewardship (<i>Avatitinnik Kamatsiarniq</i>) objectives.....	28
131	8.4 People and bears (<i>Inuillu Nanuillu</i>); objectives	29
132	8.5 Working together (<i>Piliriqatiginniiq</i>); objectives	30
133	8.5.1 Within Nunavut	31
134	8.5.2 Between jurisdictions.....	31
135	8.5.3 Sharing information and knowledge	31
136	9. IMPLEMENTATION OF THE PLAN	32
137	9.1 Harvest Management	33
138	9.2 Information and Knowledge Gathering (<i>Qanuqtuurniq</i>): Actions	33
139	9.3 Habitat Management and Environmental Stewardship (<i>Avatitinnik Kamatsiarniq</i>) Actions.....	34
140	9.4 People and Bears (<i>Inuillu Nanuillu</i>) Actions	34
141	9.5 Working Together (<i>Piliriqatiginniiq</i>) Actions.....	35
142	10. PLAN REVIEW.....	36
143	11. APPENDICES	37
144	Appendix A – Subpopulations and Status	37
145	Appendix A I – Baffin Bay (BB) subpopulation status	37
146	Appendix A II – Davis Strait (DS) subpopulation status.....	38
147	Appendix A III – Southern Hudson Bay (SH) subpopulation status	39
148	Appendix A IV – Western Hudson Bay (WH) subpopulation status.....	40
149	Appendix A V – Foxe Basin (FB) subpopulation status.....	41
150	Appendix A VI – Gulf of Boothia (GB) subpopulation status.....	42
151	Appendix A VII – M’Clintock Channel (MC) subpopulation status	43
152	Appendix A VIII – Lancaster Sound (LS) subpopulation status	43
153	Appendix A IX – Kane Basin (KB) subpopulation status	44
154	Appendix A X – Norwegian Bay (NW) subpopulation status.....	44

155	Appendix A XI – Viscount Melville Sound (VM) subpopulation status.....	45
156	Appendix B – Research Schedule.....	47
157	Appendix C – Literature Reviewed	48
158		
159		

ACKNOWLEDGEMENTS

This management plan was developed by a co-management working group consisting of Gabriel Nirlungayuk and Paul Irngaut (NTI), Markus Dyck and Paul Frame (Government of Nunavut Department of Environment), James Qillaq (QWB), Attima Hadlari (KRWB), Ross Tatty (KWB), and Chris Hotson (Okalik Consulting). Additional review and drafting of text was provided by Lynda Orman (Department of Environment), Andrew Maher (PC), Peter Hale (ECCC), and David Lee (NTI). Leetia Janes, Lazarus Arreak, Gailene Pigalak, Jackie Price, Ema Qaggutaaq, Leah M. Muckpah, and Jason Mikki assisted with community consultation.

1. INTRODUCTION

Nunavut is home to 12 of the world's 19 polar bear subpopulations, thus management actions by Nunavut are of paramount importance for ensuring the long-term persistence of the species. Management of polar bears in Nunavut predates the *Nunavut Agreement* by several decades. In the 1960s and 70s, harvest restrictions were placed on Inuit with little or no consultation. Restrictions (e.g., limiting the number of polar bears harvested per year per subpopulation) were the primary means of population recovery in regions where abundance was reduced as the result of unsustainable harvesting. Since then, implementation of the *Nunavut Agreement*, and improved research and understanding of polar bear biology has strengthened management and increased Inuit involvement. Over the last 50 years, polar bear management has focused on population recovery, which has mostly been achieved. Moving forward, the focus will be to manage polar bears sustainably, while allowing for flexibility to reduce numbers in areas where public safety is a concern and/or where there are detrimental effects on the ecosystem due to an increase in the number of polar bears. This plan has been developed to guide polar bear management in Nunavut through 2029 and explicitly recognizes the requirement to engage Inuit in polar bear management.

Inuit hunter observations indicate that polar bear numbers have increased from the population lows of the 1950s and 60s. This is confirmed by scientific studies on most Nunavut subpopulations. During the 50s and 60s, polar bears did not pose a serious threat to human safety; Inuit did not worry about going camping and families were safe in seasonal camps. Today's safety concerns are in part due to increased polar bear numbers in some Nunavut subpopulations and changes in the distribution of polar bears due to climate-driven changes in sea ice. Bears are forced to spend more time on land because the ice breaks up sooner in the spring and forms later in the fall.

Science and Inuit Qaujimajatuqangit indicate that polar bears have increased since the 1950s. However, differences exist between Inuit observations and public perspectives on the status of the species. Pressure to conserve and protect polar bears from national and international environmental and non-governmental organizations, climate change advocates, and the general public has created contention about the status of polar bear populations.

Inuit believe there are now so many bears that public safety has become a major concern. Public safety concerns, combined with the effects of polar bears on other species that Inuit and scientists are observing (e.g., ringed seal and water fowl populations) suggest that in many Nunavut communities, the polar bear may have exceeded the co-existence threshold of Nunavummiut.

212
213 “...in my lifetime we have seen opposite ends of the spectrum where
214 when I was a child we saw no bears, and now we can see
215 40 bears a year near town” Sandy Akavak, Elder, Kimmirut
216

217 In Canada, polar bears have been managed to increase populations since the 1970s,
218 largely through sustainable hunting practices. Before the fur trade and whaling, polar
219 bears were mainly harvested by indigenous peoples. The increase in whaling,
220 sealing, fur trade and Arctic explorations during the late 1800s and early 1900s
221 resulted in Arctic-wide increases in polar bear hunting by non-indigenous people. The
222 five polar bear range states, Russia, Canada, the United States, Norway and
223 Denmark (representing Greenland), agreed that the polar bear needed protection to
224 prevent a further decline, and the *Agreement on the Conservation of Polar Bears* was
225 signed in 1973. Management of polar bears has since evolved to include setting
226 sustainable harvest levels, harvest monitoring and reporting, sex-selective
227 harvesting, and other non-quota limitations (NQLs), such as the protection of family
228 groups and the protection bears in dens. Although seen by some Inuit as restrictive,
229 these NQLs are supported by the Nunavut Hunters and Trappers Organizations
230 (HTOs).
231

232 Inuit generally support Nunavut’s polar bear management efforts but have been
233 directly affected by increased polar bear abundance from the standpoint of public
234 safety and property damage (e.g., cabins and food caches). If not addressed, these
235 concerns could undermine Inuit support for polar bear management; especially when
236 the population is perceived to be high.

237 2. GUIDING PRINCIPLES

238 The following principles will guide conservation and management decisions within the
239 framework of the *Nunavut Agreement*:
240

- 241 • Integrate Inuit societal values and traditional knowledge— collectively known as
242 Inuit Qaujimajatuqangit—into polar bear management.
- 243 • Use Inuit Qaujimajatuqangit and scientific knowledge in decision-making.
- 244 • Consider public safety in all management actions and decisions.
- 245 • Consideration of the ongoing social, cultural, and economic value of polar bears
246 during decision-making.
- 247 • Consider other components of the ecosystem when making decisions about
248 polar bear conservation.

- Manage polar bears at the subpopulation level and regularly assess population status to ensure that information is available for timely conservation and long-term sustainability.
- Limit Inuit harvesting only to the extent necessary, and according to the principles of conservation, subject to the requirements of the *Nunavut Agreement*.

3. GOAL OF THE POLAR BEAR MANAGEMENT PLAN

To maintain viable and healthy polar bear subpopulations capable of sustaining harvesting needs for current and future generations, and to ensure that polar bears remain an integral and functioning part of the ecosystem while monitored, sustainable harvests occur.

4. SPECIES DESCRIPTION

Inuktitut name – Nanuq, Nanuk
English name – Polar bear
French name – Ours blanc
Scientific name – *Ursus maritimus*

4.1 Status:

SARA Listing¹: Schedule 1, Special Concern (2011)
COSEWIC Status²: Special Concern (2018)
IUCN Red List³: Vulnerable (2015)
CITES listing⁴: Appendix II (01/07/1975)
Nunavut Wildlife Act: Not assessed

4.2 General description

The polar bear is a member of the order *Carnivora* and the family *Ursidae*. It is the top terrestrial predator in the Arctic marine environment. Polar bear breeding biology is characterized by low reproductive rates, late sexual maturation and a long generation time.

¹ This is the legal status of the species on Schedule 1 of the federal *Species At Risk Act* (SARA)

² Status assessments are independent biological assessments by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC)

³ This is the global listing on the International Union for Conservation of Nature (IUCN) Red List of Threatened Species

⁴ CITES (the Convention on International Trade in Endangered Species of Wild Fauna and Flora) Appendix II includes species not necessarily threatened with extinction, but in which trade must be controlled in order to avoid utilization incompatible with their survival.

Webbed and enlarged front paws make the polar bear a strong swimmer and its curved claws are well-suited for “hooking” seals, their primary food source. Other adaptations to the Arctic environment include furred pads for improved insulation and traction on the paws, and black skin to absorb solar energy. Polar bear fur usually appears to be white, but it may also be yellowish or off-white, depending on the time of year and sex. Polar bears exhibit extraordinary strength when crushing through sea ice, digging into birth and haul-out lairs of seals, and moving large boulders to access meat caches. Adult males are larger (up to 300 cm long) and heavier (800-1000 kg) than adult females, which do not usually exceed 400 kg in weight and 250 cm in length.

4.3 Distribution

4.3.1 Global range

Polar bears occur in the Sub-Arctic and Arctic regions of the Northern Hemisphere. Satellite-telemetry studies and mark-recapture data have shown that polar bears do not wander throughout the Arctic, but rather show seasonal fidelity to local areas. Both science and Inuit *Qaujimajatuqangit* acknowledge that there is admixture between the subpopulations. Movements and distributions are determined by sea ice; a platform for feeding, mating, and denning. Globally, all polar bears are divided into 19 subpopulations. Fourteen subpopulations, including the Arctic Basin are in Canada or are shared between Canada and Greenland or the United States (Figure 1). The Global Population estimate is 26,000 with a lower confidence interval of 22,000 and an upper confidence interval of 31,000. Approximately 14,000 - 16,000 polar bears occur in Canada. Most of Canada’s polar bear subpopulations occur in Nunavut.

4.3.2 Nunavut range

As of 2019, there are 12 recognized subpopulations of polar bear within Nunavut (Baffin Bay, Davis Strait, Southern Hudson Bay, Western Hudson Bay, Foxe Basin, Kane Basin, Lancaster Sound, Norwegian Bay, Gulf of Boothia, M’Clintock Channel, Viscount Melville Sound, and Northern Beaufort Sea). Eight of these subpopulations are shared with other jurisdictions and user-groups and four are entirely within Nunavut (Figure 1). A more detailed background and description of Nunavut’s polar bear subpopulations, along with management recommendations are provided in Appendix A.

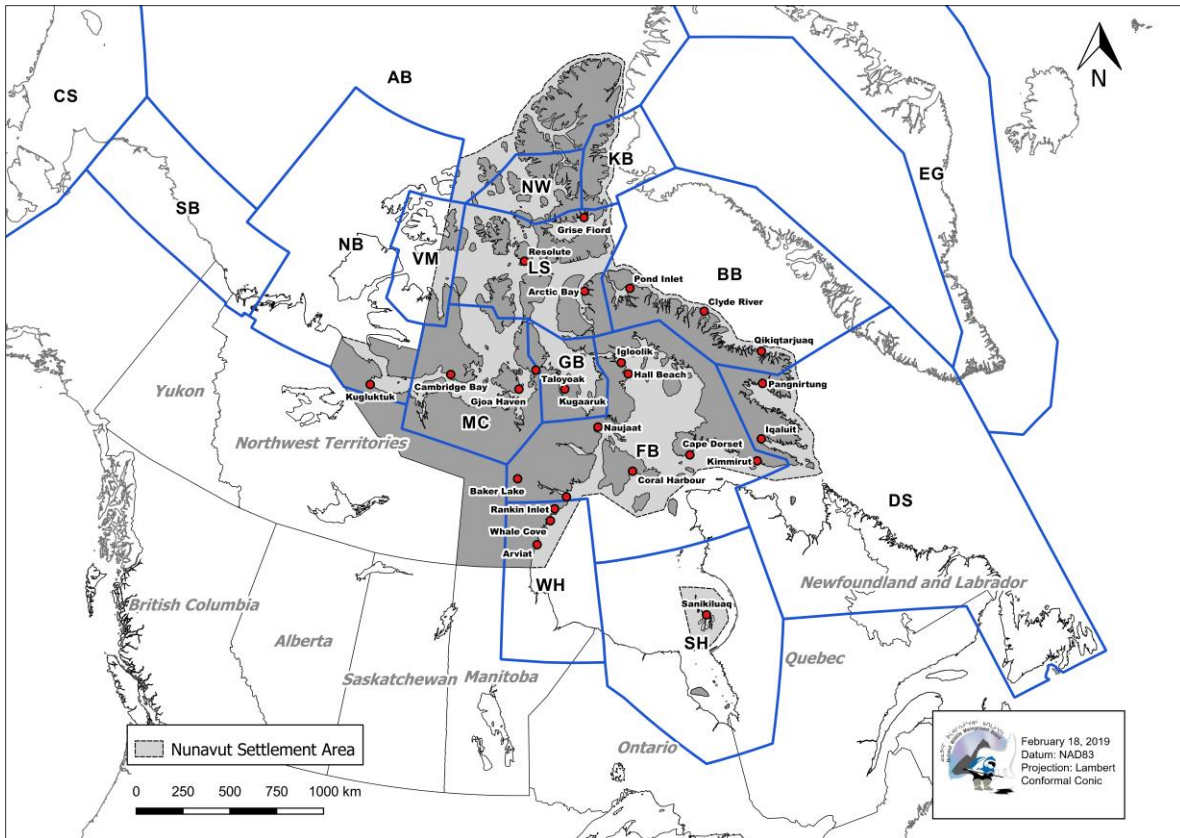


Figure 1. Canadian and Nunavut polar bear subpopulations [BB = Baffin Bay; DS = Davis Strait; SH = Southern Hudson Bay; WH = Western Hudson Bay; FB = Foxe Basin; GB = Gulf of Boothia; MC = M'Clintock Channel; LS = Lancaster Sound; KB = Kane Basin; NW = Norwegian Bay; VM = Viscount Melville Sound; NB = Northern Beaufort Sea; SB = Southern Beaufort Sea.

4.4 Biology

4.4.1 Life cycle and reproduction

Breeding occurs between March and June. Ovulation is induced by mating, but implantation of the fertilized egg is delayed until October. Female age at first reproduction ranges between four and seven years, with most females producing litters by age six. By age six, male polar bears are normally reproductively mature, however younger males often do not reproduce due to competition from older and bigger males. Most males enter the reproductive segment of the population between eight and ten years old.

Pregnant females prepare and enter maternity dens in late fall and the cubs—normally one or two—are born between November and early January. Inuit Qaujimajatuqangit suggests that the timing of birth is later in higher latitudes. In northern subpopulations dens are generally excavated in snow and are covered and closed by snowdrifts. They are frequently located on islands or land that is near the coast and adjacent to areas with high seal densities in spring. An anomaly to this

pattern of behaviour is the maternity dens for the Western Hudson Bay and Southern Hudson Bay polar bears, that can be located up to 120 km inland at traditional den sites and are initially dug in soil.

At birth, cubs weigh approximately 0.6 kg. They are nursed inside the den until sometime between the end of February and the middle of April. By this time, cubs weigh 10-12 kg. A new litter is produced after three years, making the average inter-litter interval approximately 3.6 years.

4.4.2 Natural mortality and survival

Other than humans, adult polar bears have no natural predators. Cubs less than one year old sometimes are prey to wolves and other carnivores. Walruses have also been reported to kill polar bears in self-defence, but this is infrequent. Polar bears have also been observed killing other polar bears. Each life-stage of a polar bear comes with different challenges, such as hunting success, hunting experience, and social status; therefore, the survival rates vary accordingly. Moreover, survival also varies among subpopulations because of differences in ecosystem productivity and seasonal ice duration.

Biologists recognize four important age categories: 1) cubs-of-the-year; 2) yearlings and sub-adults, 3) prime-age adults, and 4) senescent adults. These categories are also divided by sex because males generally have lower survival rates than females. In the wild, the maximum age is estimated to be 30 years.

4.4.3 Diet

Polar bears are carnivorous. Throughout their Nunavut range, ringed, bearded and harp seals make up most of the polar bear's diet. The abundance and population dynamics of polar bears is therefore, strongly connected to that of ringed, bearded and harp seals. Other species like harbour seals, walrus, beluga whale, narwhal, bowhead whale and birds are hunted opportunistically. Polar bears are also known to eat eggs, berries, and seaweed.

Polar bear diet varies throughout the year, and across its range. Primary feeding tends to be in spring when seal pups are abundant. However, polar bears will hunt and scavenge throughout the year, feeding opportunistically on vegetation, berries, eggs, and birds. Fish and ringed seals are also successfully hunted when there is little or no sea ice in summer.

Polar bears are well-adapted to times of food abundance and shortages. When food is in high abundance, they can increase their body mass significantly and when food becomes scarce or unavailable, they can live off their stored fat reserves.

4.4.4 Habitat

Polar bears can be found in all coastal and offshore areas of the Canadian SubArctic and Arctic. They hunt from sea ice to access their primary prey—seals. The condition and extent of sea ice is a key factor in determining the quality of the habitat. However, they seem to be adapted to all types of sea ice and are strong swimmers capable of traveling long distances in open water. Inuit have observed that bears can exist in open water and on sea ice for most of their lives (the Inuktitut term for this is *tulayuituq*). Access to land is essential during the ice-free periods, but also for mid-winter denning.

In Nunavut, polar bears den mostly on land. Denning sites are locations that have enough snow cover in early winter for the construction of the dens. Dens can also be found on moving multi-year ice and areas of annual rough ice. All maternity denning sites are important areas because they provide shelter for the mother and offspring. All maternity denning sites are protected under the Nunavut *Wildlife Act*. Maternal dens that occur inside protected areas are also protected by regulations governing such areas.

5. BACKGROUND ON POLAR BEAR MANAGEMENT

5.1 Historical perspective

The polar bear management system in Nunavut dates back to the Northwest Territories, when Nunavut was not yet a territory. This system includes setting of harvest limits (known as Total Allowable Harvest or TAH under the *Nunavut Agreement*), instituting harvest seasons, reporting harvests, and sample submission. After the creation of Nunavut, memoranda of understanding for each subpopulation were implemented between the Department of Environment and each RWO and HTO to guide harvest and management.

5.2 The Nunavut perspective

In the past, polar bear management in Nunavut has mainly focused on sustainable harvesting using population estimates derived from scientific studies. Although abundance in most subpopulations was low prior to the 1970s (the reason for the *Agreement on the Conservation of Polar Bears*), some populations have increased to greater densities than historically lower numbers. As of 2019, the statuses of the 12 subpopulations in Nunavut as determined by the Polar Bear Technical Committee (PBTC)⁵ are: three uncertain, one likely decline, four likely stable, two stable, and two

⁵ The Polar Bear Technical Committee (PBTC) was setup to support the Polar Bear Administrative Committee (PBAC) by reviewing scientific research and Indigenous Traditional Knowledge and providing the PBAC with an annual status assessment of the polar bear subpopulations in Canada

likely increase. Nunavummiut believe that polar bears have become less afraid of humans and more likely to damage property, as the result of an apparent increase in polar bears in some areas. In Nunavut, human safety and the right of Inuit to harvest are high priorities⁶. Increased interactions between humans and bears, and a right to protect human safety and property have led to an increase in defence kills. Considering all removals come off the TAH this can lead to a reduction in the community harvest, resulting in a loss of opportunity for traditional harvesting activities.

5.3 Legislative frameworks and agreements

In Nunavut, wildlife is managed according to Article 5 of the *Nunavut Agreement*. Article 5 recognizes the rights of Inuit to harvest polar bears and trade in polar bear products⁷. It also sets out the creation of the Nunavut Wildlife Management Board (NWMB), which is the primary instrument of wildlife management in Nunavut. It defines the roles of the NWMB, Department of Environment, RWOs and HTOs.

The Nunavut *Wildlife Act* (2015) sets out harvest management, licensing, reporting and sample submission. Further details on management, including research, harvest, and TAH determinations have been detailed in previous Memoranda of Understanding (MOUs) developed for all subpopulations (12) jointly with RWOs, HTOs and the Department of Environment. These MOUs shall be replaced with this management plan. Enforcement provisions are in place in regulations under the *Nunavut Wildlife Act*.

In Nunavut, each of the co-management partners fulfills its respective role as defined in the *Nunavut Agreement* (see Figure 2). This plan applies to the Nunavut Settlement Area as defined in Section 3.1.1 of the *Nunavut Agreement*.

The Polar Bear was listed as a species of Special Concern under SARA in 2011. A Special Concern designation is used for species that may become threatened or endangered because of a combination of biological characteristics and identified threats⁸. While there are no associated effects on Inuit harvest or management actions, a management plan must be developed and published on the *Species at Risk Public Registry* for all species of Special Concern.

This plan may be adopted—in whole or part—as the Nunavut territorial component of the national management plan under the federal *Species at Risk Act*, while respecting the co-management process legislated by the *Nunavut Agreement*.

In 1973, Canada was a signatory to the *Agreement on the Conservation of Polar*

⁶ See Sections 5.1.2 and 5.6.1 of the Nunavut Agreement

⁷ See Sections 5.6.1 of the Nunavut Agreement

⁸ <https://www.canada.ca/en/environment-climate-change/services/species-risk-public-registry/glossary-terms.html>

Bears. The *Agreement* holds member states accountable for acting to protect the ecosystems in which polar bears live, paying special attention to places where polar bears den, feed, and migrate. Range states also must manage polar bear populations in accordance with proper conservation practices, based on best available scientific data. Recently, range states have agreed to include Inuit Qaujimajatuqangit as part of the body of knowledge to be considered for polar bear conservation and management. There also exists inter-jurisdictional agreements between Canada and Greenland for the Davis Strait, Baffin Bay and Kane Basin subpopulations, and Canada and the United States for the Southern Beaufort Sea subpopulation.

6. POLAR BEAR CO-MANAGEMENT IN NUNAVUT

The *Nunavut Agreement* and *Nunavut Wildlife Act* provide the overarching criteria and principles under which Inuit harvesting of polar bears is managed.

6.1 Decision criteria

Conservation, public health and public safety are among the purposes for which Inuit harvesting of polar bears may be limited. Decisions made by the NWMB and Minister must limit Inuit harvesting only to the extent necessary.

6.2 Principles of conservation

Decisions made by the NWMB and Minister must apply the following principles:

- the maintenance of the natural balance of ecological systems within the Nunavut Settlement Area;
- the protection of wildlife habitat;
- the maintenance of vital, healthy, subpopulations capable of sustaining harvesting needs, and
- the restoration and revitalization of depleted subpopulations and wildlife habitat.

6.3 Co-Management partners

The following co-management partners participate in polar bear management; their roles are defined in detail in Section 5 of the *Nunavut Agreement*. A summary is provided below. Figure 2 details the partners and the decision-making process.

6.3.1 Nunavut Tunngavik Inc.

Nunavut Tunngavik Incorporated (NTI) represents all Inuit in the Nunavut Settlement Area, in line with the *Nunavut Agreement* that was signed in 1993 by the Inuit of the Nunavut Settlement Area and Her Majesty the Queen in right of Canada. The *Nunavut Agreement* supersedes legislation and is constitutionally protected under Canada's *Constitution Act* (1982).

6.3.2 NWMB

The roles of the NWMB are defined in the *Nunavut Agreement*, sections 5.2.33 and 5.2.34. These include, but are not limited to, setting TAH, Basic Needs Levels, and NQLs. In addition, the NWMB may approve management plans and the designation of rare and endangered species.

6.3.3 RWOs

The role of RWOs is defined in section 5.7.6 of the *Nunavut Agreement*. The role of the RWOs includes, but are not limited to, regulating the activities of HTOs in their regions, including allocating TAH among communities, and distributing any accumulated harvest credits (one unharvested bear equals one credit) as required to cover accidental, defence, or illegal kills. The RWOs may also return credits annually to augment a community's harvest. Credits may not be transferred between communities that share a subpopulation without the written consent of the community that accumulated the credit.

6.3.4 HTOs

The role of HTOs is defined in sections 5.7.2 and 5.7.3 of the *Nunavut Agreement*. The roles of HTOs include, but are not limited to, regulating the harvesting activities of their members, including all Inuit within the community. HTOs allocate tags within their respective communities for species with a TAH and set harvest seasons. As per the *Nunavut Agreement*, HTOs may develop rules for NQLs. HTOs may also open and close their polar bear hunting seasons to optimize hunting and may determine if sport hunts will be allowed in the community.

6.3.5 Government of Nunavut

The Nunavut Minister of Environment retains the ultimate authority over polar bear management in Nunavut as per the *Nunavut Agreement*. Department of Environment staff conduct research, record Inuit Qaujimajatuqangit, and make management recommendations to the NWMB for decision. Department of Environment Conservation Officers enforces the *Nunavut Wildlife Act* and its regulations. Department of Environment implemented new programs starting in 2013 to reduce human-bear conflicts and to reduce and compensate communities for damage to personal property by polar bears. The Government of Nunavut also works with the Government of Canada (Environment and Climate Change Canada) and the Government of Greenland to manage and conserve polar bears in the shared Kane Basin and Baffin Bay polar bear subpopulations.

6.3.6 Government of Canada

Under SARA, Environment and Climate Change Canada (ECCC) is responsible for completing a national management plan for polar bears and has responsibilities for

the management of listed species where they occur on federal lands. The Government of Canada is responsible for managing polar bears and their habitat on federal lands under the jurisdiction of the federal Minister of Environment (National Wildlife Areas, Migratory Bird Sanctuaries, National Parks, National Park Reserves, and National Historic Sites). The Government of Canada contributes to scientific knowledge of polar bears through research and helps to coordinate polar bear management across the country. Canada signs international agreements on behalf of all jurisdictions and has responsibilities to coordinate international management actions for polar bears, with the advice of the co-management boards and jurisdictions. It is involved in international polar bear management including the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) and the *1973 Agreement on the Conservation of Polar Bears*. When developing positions that relate to international agreements affecting Inuit harvesting rights in the Nunavut Settlement Area, the Government of Canada is required under the *Nunavut Agreement* to include Inuit in discussions.

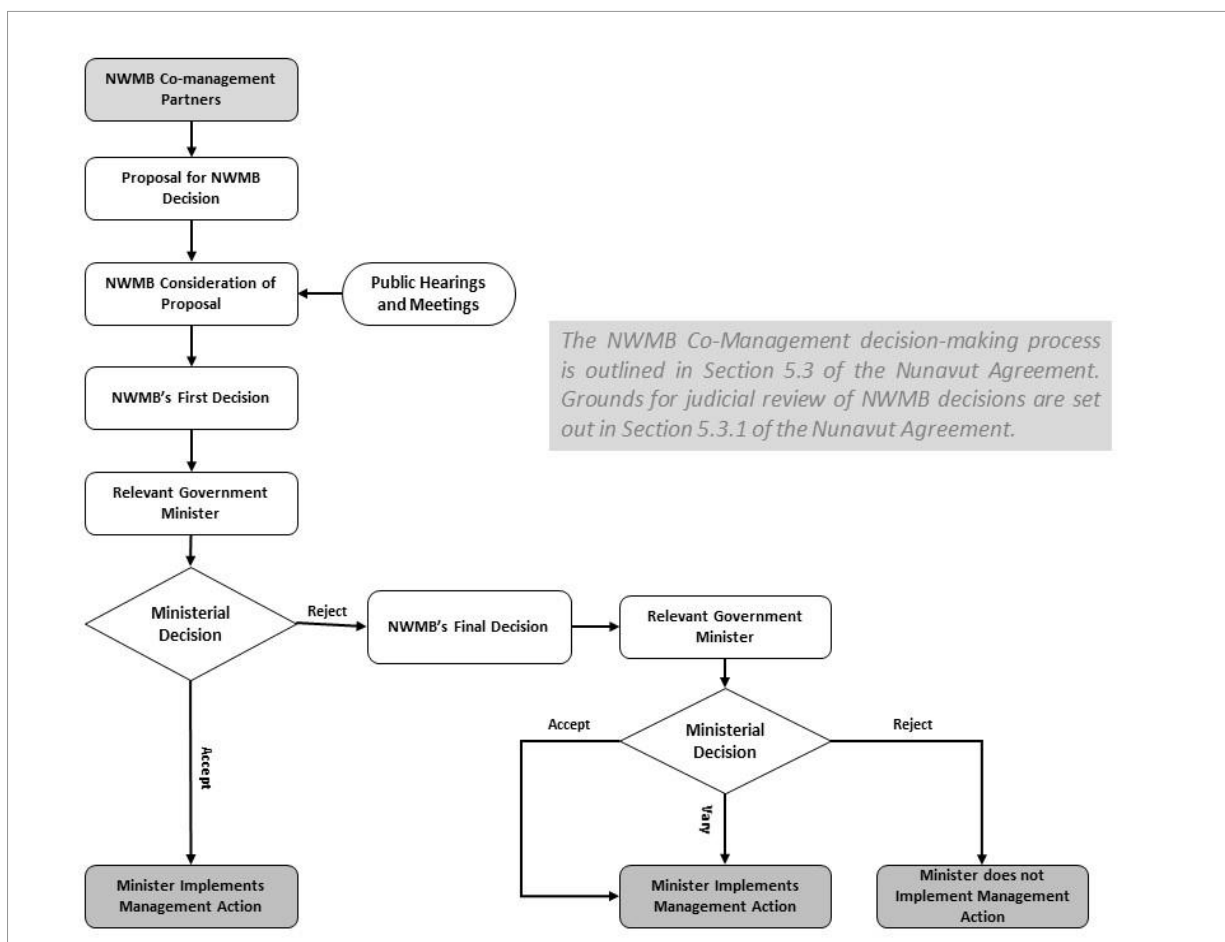


Figure 2. The Wildlife Co-management decision-making framework in Nunavut (NWMB 2019).

7. CONSERVATION THREATS AND CHALLENGES

7.1 Threats

In Nunavut's adaptive co-management system, any threat can be identified and responded to relatively quickly. For example, if a significant reduction in the body condition, recruitment, or overall abundance of a subpopulation is detected and attributed to a threat, the appropriate conservation measures will be implemented to stop or mitigate the observed threat. The following are current threats, or threats expected to occur within the 10-year life of this plan.

7.1.1 Sea-ice habitat loss and alteration due to climate change

Climate change is affecting terrestrial and marine environments in Nunavut. It is projected that increasing Arctic warming will lead to a decrease in the extent and thickness of multi-year sea ice, and the duration and thickness of annual sea ice. These changes will affect polar bear sea-ice habitat, the availability and abundance of prey species, and the ability of polar bears to access prey. While no subpopulation declines have been attributed to climate change, there is growing scientific evidence linking the impacts of climate change to current and future declines in body conditions, cub survival, and subpopulation sizes. Inuit Qaujimajatuqangit agrees that polar bears are exposed to the effects of climate change but suggest that they are adaptable.

*“..people (in the south) think climate change will hurt polar bears
, but the bears will adapt, and there will always be an Arctic and ice”.*

Leopa Akpalialuk, Pangnirtung HTO Board Member

It is challenging to predict and mitigate the effects of climate change on the polar bears' sea-ice habitat. Adaptive management and frequent subpopulation assessments will allow for more responsive decision-making in response to climate change. The loss of annual sea ice in southern subpopulations may be offset by improvements to heavy multi-year ice in other portions of the range. Subpopulation boundaries may shift as polar bears adapt to changes in their environment.

7.1.2 Denning habitat alteration due to climate change

Other important habitat includes denning and coastal areas used as summer retreat areas during ice-free periods. In Nunavut, most polar bears den on land, either along the slopes of fiords, on peninsulas or islands. All maternity denning sites are important areas because they provide shelter for the mother and offspring and contribute to the growth of the population. There are concerns that current and future changes in climatic conditions (e.g. winds, storm surges, flooding and shoreline erosion, and insufficient snow accumulation) and increasing anthropogenic activities may alter maternal denning habitat or render previously important denning sites unsuitable or inaccessible.

A significant amount of polar bear habitat, including known denning areas, occur within the boundaries of National Parks, Territorial Parks, or other protected areas, such as Migratory Bird Sanctuaries and National Wildlife Areas. Protected areas will, therefore, play an increasingly important role in the face of increasing human activities in the Arctic.

7.1.2 Industrial activity

In Nunavut, there are several active and proposed mines, and other industrial pursuits, that could affect polar bears directly, or indirectly through increased shipping traffic and pollution. Noise and disturbance from humans or exploration activity in any form near dens could cause disturbance, the abandonment of offspring, or the displacement of denning bears if it is not carefully planned and controlled. Any shipping activities through feeding areas may lead to disturbance and reduce the hunting success of polar bears. These activities could also increase the abandonment of seal dens. If industrial activities (e.g., oil or gas exploration and development, shipping, mining exploration and operations) lead to an oil spill in sea-ice habitat, polar bears and seals will be directly exposed to oil, with effects ranging from ingestion of oil, hair loss, kidney failure to ultimately death. Increasing industrial activities may cause an increase in the local human population (both the indigenous population and non-indigenous people), as well as the amount of refuse and other wildlife attractants. Consequently, polar bear-human encounters are also likely to increase, leading to a potential increase in conflicts between polar bears and humans.

7.1.3 Pollution/contaminants

Polar bears are at the top of the Arctic food chain, and as such accumulate high levels of various environmental pollutants through the food they ingest. Most of these polluting compounds, namely organochlorines, reach the Arctic via wind and ocean currents from industrialized areas. Environmental pollutants bioaccumulate through the food chain and have been found in polar bear tissue, particularly in males. In females, it has been demonstrated that contaminants can be transferred to the offspring via their mother's milk.

How these pollutants and chemical compounds will affect polar bear health and fitness over the long-term is not well known. It has been suggested that high concentrations of contaminants could adversely impact immune and reproductive systems. A combined and persistent response to these stressors is anticipated.

7.1.4 Tourism

Interest in Arctic tourism has grown because of easier access to remote destinations across the Arctic. Any increase in tourism activity or the cumulative impacts of several negative human stressors (e.g. tourism, mining, shipping and contaminants) can have unintended impacts on polar bear health, reproduction and mortality. Unlike Manitoba—

that has a tourism industry focused on polar bears — Nunavut does not have a polar bear tourism industry. However, various locations in Nunavut offer similar opportunities and could become focal points for intense polar bear viewing. Some Inuit have expressed concerns that tourism and research related to polar bear handling and habituation, such as in Churchill, Manitoba, is the reason polar bears have lost their fear of humans and tend to come into communities. The impacts of tourism can be limited by proper policies and management.

7.2 Challenges

7.2.1 Subpopulation boundaries

The division of polar bears into subpopulations is based on movement patterns estimated from satellite telemetry data, and ear tags returned from harvested bears. Although boundaries are accepted for management purposes, it is understood that bears occasionally move across these management boundaries. It is important to recognize that these boundaries have formed the basis for management actions for over four decades and have been relied on by managers to set harvest levels and by researchers focusing their subpopulation assessment studies.

Inuit believe that polar bears regularly travel among different geographic areas of Nunavut and that there may be fewer than 13 subpopulations in Canada. As the understanding of the structure of polar bear populations improves, there will be an ongoing need to review current subpopulation delineation. Ongoing studies using satellite telemetry collars in the Western Hudson Bay subpopulation by ECCC researchers may provide information that could result in boundary changes. It will remain a challenge to balance Inuit perspective on population structure with current subpopulation designations. Maintaining Inuit support for subpopulation boundaries is fundamental to the success of polar bear management in Nunavut. Reconciling Inuit Qaujimajatuqangit with scientific knowledge as it evolves will be a necessary, but considerable challenge.

7.2.2 Polar bears and people

Inuit and their ancestors have lived in proximity to polar bears for thousands of years. The human population in Nunavut is currently higher than it has ever been and continues to grow. At the same time, it is recognized that, in many areas across Nunavut, there are more polar bears now than 40 or 50 years ago. Human-bear interactions have increased and have led to an increase in polar bear mortality in defence of life and property.

These Defence of Life and Property Kills (DLPKs) are included in the TAH and reduce Inuit harvesting opportunities. DLPKs occur in communities, on the land, and in hunting

and fishing camps. Inuit have stored meat for centuries in traditional meat caches, both within small traditional camps on the land, and within communities. The loss of nutritious food due to polar bear depredation is a significant cost to Inuit. In addition to polar bear mortality associated with DLPKs, human-bear interactions can also lead to damage, including damage to cabins and bear destruction of meat caches.

Reduced hunting opportunities and associated loss of meat and hide are only part of the impact Inuit feel from harvest restrictions. There is also an impact on the transfer of Inuit knowledge and culture over time when restrictions are in place.

“...it is like ripples in a pond, we lose the hide and the meat and the hunt, but there is also a loss of culture and knowledge. We no longer travel to the areas we used to hunt polar bears, so a generation has no knowledge of the land and traditional camping areas, we no longer have sport hunters so we no longer keep dog teams, and we cannot pass on that knowledge, we no longer have skins to handle and women cannot pass on the skills to prepare and sew.”

David Irqut, HTO Director and Elder, Taloyoak

7.2.3 Inter-jurisdictional considerations

In Nunavut, eight of 12 polar bear subpopulations are shared with other jurisdictions. The shared populations are Northern Beaufort Sea and Viscount Melville Sound (shared with NWT*), Foxe Basin (shared with Quebec*), Southern Hudson Bay (shared with Ontario* and Quebec*), Western Hudson Bay (shared with Manitoba*), Davis Strait (shared with Labrador*, Quebec* and Greenland*), and Baffin Bay and Kane Basin (shared with Greenland). Cooperative efforts on research and consultation between jurisdictions should be encouraged as part of these efforts. Current jurisdictional efforts to consider combined total allowable removal levels between jurisdictions are a positive step for cooperative management. However, this remains a significant challenge due to the complexities of multiple jurisdictions and land claims.

(*This denotes a simplified relationship between jurisdictions and does not reflect the respective sub-jurisdictional entities and their respective stakeholders and Boards).

7.2.4 Trade

The CITES Convention of 1973 has been in effect in Canada since July 1975. Polar bears are listed in *Appendix II* to the Convention and trade is allowed under strict conditions — including that it must be non-detrimental to the species and CITES permits are required.

As the responsible authority for the implementation of CITES, ECCC must determine if the export or import of a species would be detrimental to the survival of that species.

Such “non-detrimental findings” (NDFs) are a requirement of the Convention. The international export of polar bears from Canada is currently considered non-detrimental.

Given the shared jurisdiction for wildlife in Canada, coordination among provincial and territorial jurisdictions is required to ensure that total removals among jurisdictions within shared subpopulations is sustainable and defensible at the national and international levels.

Ongoing domestic and international export of polar bear parts, such as hides, depends on sound harvest reporting and sustainable harvest levels. Communities have unanimously supported efforts to maintain international trade of polar bear specimens as an important component of community economic development. The listing of polar bears on CITES *Appendix I* would have a negative impact on conservation efforts as the economic benefit to communities will be reduced, and the incentive to manage for abundant populations will be lost. In September 2015, the Animal Committee of CITES determined that the current trade in polar bear hides and parts is not detrimental to the survival of the species in the wild.

8. MANAGEMENT PLAN OBJECTIVES

The following five main components are considered important for co-management partners to achieve the goal of the management plan:

- Harvest management (*Angujaujunnaqtunik Aulattiniq*)
- Information and knowledge gathering (*Qanuqtuurniq*)
- Habitat management and environmental stewardship (*Avatitinnik Kamatsiarniq*)
- People and bears (*Inuillu Nanuillu*)
- Working together (*Piliriqatiginniiq*)

8.1 Harvest management and objectives (Angujaujunnaqtunik Aulattiniq)

8.1.1 Harvest management

Legislated harvest restrictions have been the primary management tool used to facilitate the recovery of polar bear subpopulations throughout Nunavut. As new information becomes available, co-management partners work together to consider or review a TAH for each polar bear subpopulation. The TAH represents the total number of polar bears that can be harvested according to the management objective of the subpopulation. These numbers are based on detailed scientific data, population trends, Inuit Qaujimaqatuqangit, and harvest history.

Where a TAH is established, HTOs have the choice to harvest the set number of bears for their own needs or to allocate a portion of the TAH for guided sport hunts. All bears harvested, whether for subsistence purposes, sport hunts, or in defence of life and

property, are accounted for and subtracted from the annual TAH of the nearest community. If human-caused mortality exceeds the annual community TAH, additional tags will be issued and will be counted as part of the following year's TAH. Any portion of the TAH that goes unused will be counted as credits, which can then be used in subsequent years. Unused credits are zeroed, when a new subpopulation estimate is generated and a new TAH is established. This accounting regime is known as the Flexible Quota System⁹.

While the TAH for each polar bear subpopulation is subject to change, the following harvest restrictions have been established by the NWMB for enactment in the *Nunavut Wildlife Act* and do not vary according to subpopulation dynamics or annual removals:

1. No person shall harvest a polar bear that is under three years of age unless
 - a. It appears to be abandoned by its mother; or
 - b. Its mother was killed or harvested as an emergency kill in accordance with section 97 of the Act and there is little likelihood of it surviving.
2. No person shall harvest a female polar bear that is accompanied by a bear that is or appears to be under three years of age (A polar bear is deemed to be three years old on the first day of the January that follows the third summer after its birth).
3. No person shall harvest a female polar bear that is in a den or that is constructing a den.

The use of NQLs, including seasonal harvest restrictions and the protection of family groups are also important components of Nunavut's polar bear harvest management regime.

8.1.2 Selective harvesting

Selective harvesting of wildlife populations is a common management practise whereby individuals of a certain age, sex or body size are selectively harvested to achieve a specific management goal. In Nunavut, age- and sex-selective harvesting have been used to recover polar bear populations, while maximizing harvest opportunities for Inuit.

Sex-Selective Harvesting

Polar bears are a polygynous species, which means that one male often mates with multiple females during a single breeding season. Accordingly, a few male bears can sire many offspring. Females generally only mate once every 2-4 years because they must give birth and raise their young alone. Therefore, the number of females in a given

⁹ The flexible quota system is used in Nunavut to administer the portion of the Total Allowable Harvest allocated to a given community. The system allows for credits to be accumulated when the annual allocation is under-harvested and for over-harvested bears to be subtracted from the next year's base allocation.

population is the most important factor affecting the future abundance and population growth. Scientific modelling has shown that harvesting two males for every female is the best way to increase/maintain polar bear populations, while simultaneously maximizing the harvest.

The two males for every female harvest ratio has been instrumental to the conservation management of polar bears in Nunavut. However, communities throughout Nunavut have expressed concerns about the difficulties in the administration of the sex-selective harvesting and the excessive penalizations that occur when females are over-harvested.

The current management system adopts a one male to one female harvest ratio for all Nunavut subpopulations, until there is new information from science or Inuit Qaujimajatuqangit showing that there has been a decrease in a subpopulation's size or the survival of females, and there is a conservation concern. In this new system, the overharvest of females will be penalised by removing the same number of females from the following year's allocation.

Age-Selective harvesting

As noted above, only those bears that are three years of age and older can be harvested. This is meant to ensure polar bear populations remain stable via the recruitment of new cubs.

8.1.3 Harvest reporting and monitoring

Timely harvest reporting and sample collection are essential components of any wildlife management system. They provide invaluable information about population health and are required to maintain international trade in polar bear specimens. The following body parts and measurements shall be collected from each polar bear that is harvested in Nunavut:

- (a) lower jaw, as proof of species
- (b) baculum (penis bone), as proof of sex in the case of males
- (c) ear tags, if present
- (d) straight line body length and chest girth
- (e) other samples or measurements, as required (e.g., liver, body condition, body size, etc.).

It is recognized that consultation and training may be required before additional information can be collected. Hunters will be paid for samples at a rate determined by the Department of Environment. In the event of a defence of life or property kill (DLPK), the Superintendent of Wildlife (Department of Environment) may authorize

payment for samples collected by HTOs or individuals on behalf of the Department if there is no Conservation Officer in the community.

8.1.4 Potential harvest management actions and scenarios

1) If a decline in a subpopulation's size is noted by science/ Inuit Qaujimajatuqangit, and the objective is to increase or maintain the subpopulation's size, actions may include:

- Switch to a two male for every female sex-selective harvest ratio if female or cub survival is low;
- Reduce the TAH or institute a moratorium until the desired target number is reached.

2) If an increase in a subpopulation's size is noted by science/ Inuit Qaujimajatuqangit and the objective is to decrease or maintain the population size, actions may include:

- Increase or maintain the TAH. If the TAH is increased, appropriate monitoring must be conducted as a follow-up to measure the success of the management action;

3) If a subpopulation's size is determined to be stable by science/Inuit Qaujimajatuqangit and the objective is to maintain the population at the current level, actions may include:

- Maintain the current harvest conditions unless there is evidence of declining body condition or recruitment.

8.2 Information and knowledge gathering (Qanuqtuurniq) and objectives

8.2.1 Gaining knowledge

To date, most polar bear research has focused on the estimation of population abundance and trends, and the delineation of population boundaries using physical mark-recapture and telemetry collars. Inuit resistance to polar bear handling resulted in a shift to less invasive methods, including genetic mark-recapture studies and aerial surveys. These new methods do not require the handling of bears but require more frequent surveys and do not provide the same degree of detailed information that can be obtained from mark-recapture and telemetry studies.

Due to the Department of Environment's shift to less invasive research methods, a variety of information that biologists previously obtained through physical mark-recapture and telemetry is no longer available. With proper training, communities and harvesters can voluntarily collect some of this information from the bears they harvest

or observe (e.g., body condition, bears with single cubs, twins and triplets, etc.). This will aid in understanding polar bear biology and ecology more broadly.

In addition to ongoing scientific research and monitoring, improvements are being made in the collection of Inuit Qaujimajatuqangit for use in decision-making. Inuit observe bears year-round and provide current and historical knowledge relevant to decision-making. Harvester observations of body condition can be used to help infer health, as can observations of reproductive success, such as bears with single cubs, twins and triplets. Additionally, Inuit have repeatedly expressed the view that polar bears appear to move between subpopulations and there may be an increased role for Inuit Qaujimajatuqangit to play in the ongoing identification and characterization of subpopulations.

The following objectives are aimed at providing information that will help in making decisions:

- Increase the frequency of population surveys and monitoring;
- Continue to improve Inuit involvement and participation in research;
- Improve and continue gathering and archiving Inuit Qaujimajatuqangit in relation to polar bears and their habitat;
- Improve and continue to collect supplementary information of harvested bears by hunters;
- Continue to develop and evaluate new and less invasive methods of research;
- Consider not only the effects of ecosystem changes on polar bears but also how polar bears affect other species, specifically ringed seals and eider ducks;
- Continue genetic research and collaring to clarify potential boundary changes if needed and supported by communities;
- Review existing management boundaries;
- Improve information collection and reporting related to polar bears and bear-human interactions;
- Improve the analysis of bear-human interactions to determine causes and potential mitigation measures;
- Continue traditional mark-recapture and delineation studies using collars where needed and supported by communities.

8.2.2 Research

The Department of Environment intends to conduct population inventories of each subpopulation on average every ten years (depending on the monitoring techniques applied). Harvest statistics and sample collection will continue to support

management decisions. When possible, a concurrent Inuit Qaujimajatuqangit study will be conducted to complement the population inventory. A schedule of subpopulation inventories and Inuit Qaujimajatuqangit studies is found in Appendix C.

Community residents (with priority to HTO members) shall have the opportunity to participate in polar bear research projects. HTOs will have input into the proposed studies, and Inuit Qaujimajatuqangit will be used to guide research efforts.

In addition to the ongoing population monitoring conducted by the Department of Environment, other partner organizations and individuals conduct research on polar bears throughout Nunavut. Some of these initiatives include research examining the impacts of contaminants and climate change on polar bear populations, ecological studies, feeding studies and many others. The information gathered through these projects will be considered in management decisions as well.

While the Government of Nunavut has invested considerable effort into the development and use of less invasive research methods to study polar bears, there may be instances when collaring and physical mark-recapture studies are needed to collect more detailed information. The Government of Nunavut will seek the support of HTOs prior to implementing studies that use these methodologies.

Physical mark-recapture and collaring studies require researchers to use immobilizing drugs to safely handle polar bears. When a bear has been immobilized within one year of the date of harvest, \$1000.00 compensation will be paid to the hunter who harvested the polar bear. HTOs will be consulted and informed of all research initiatives involving the use of chemical immobilization; harvesters can consult their local conservation officer to determine whether a bear has been previously immobilized. Any damage to the hide from research activities will be compensated for based on the reduced amount of the hide's market value. Also, when a bear is destroyed during Department of Environment's polar bear research activities, the nearest community HTO will provide a tag and will be paid \$5,000.00 in compensation from the appropriate government authority. These compensation amounts will be reviewed during the 5 and 10-year reviews of the plan. Environment and Climate Change Canada and Parks Canada Agency also have guidelines for research-related polar bear mortality. HTOs are encouraged to negotiate compensation packages with other researchers or companies that may destroy a bear in defence of life and property when the community reviews the respective research or development permits.

8.3 Habitat management and environmental stewardship (*Avatitinnik Kamatsiarniq*) objectives

Polar bears use most parts of the Arctic and SubArctic habitat in which they live.

Polar bears are highly mobile and may be found on annual and multi-year ice, land, or in open water. It will take significant effort to ensure that polar bear habitat remains available and usable because of the vastness of the Arctic and the fact that many threats originate elsewhere or are global in nature. Stewardship can be partially achieved through regulatory processes that occur within Nunavut. However, contaminants that are brought north by wind and ocean currents and habitat changes due to climate change are issues that occur far beyond Nunavut and will require global action to address.

Current habitat stewardship is further supported by the existing parks and protected areas in Nunavut, including National Parks, Territorial Parks, Migratory Bird Sanctuaries, and National Wildlife Areas.

Objectives that promote stewardship and protect habitat must be local and consider the broader causes and issues. These objectives include:

- Ensure that stakeholders have the resources and information to participate effectively in regulatory reviews, such as Environmental Impact Assessments;
- Improve monitoring for contaminants and diseases to respond to potential health concerns resulting from human consumption;
- Consider how increasing shipping and resource development activities may affect polar bears at the individual and subpopulation level;
- Improve understanding of the negative and positive impacts of climate change on polar bear ecology;
- Identify important habitats for polar bears and implement appropriate habitat protection measures through cooperation with appropriate partners and jurisdictions;
- Consider the creation of special management areas, parks, and other land use designations for additional habitat protection and stewardship.
- Generally, assist Canada to meet its obligation under Article II of the *International Agreement on Conservation of Polar Bears* i.e. to “take appropriate action to protect the ecosystems of which polar bears are a part, with special attention to habitat components such as denning and feeding sites and migration patterns.”

8.4 People and bears (*Inuillu Nanuillu*); objectives

The polar bear maintains a position of significant cultural importance to Inuit. Harvesting polar bears for meat, tradition, and economic benefit is still very important, and the harvest of one’s first bear is a significant milestone in a hunter’s life. Minimizing DLPKs and maintaining the traditional harvest are important to all

communities in Nunavut.

When a DLPK occurs, the hide, meat, and other parts of harvested polar bears are turned over to the local HTO after the conservation officer has determined that it is a legitimate DLPK. When there is an irregular or illegal kill, the conservation officer will seize the parts of the bear necessary to complete the investigation. The samples of the killed bear are collected as normal. When it has been determined that the kill was accidental or a DLPK, the conservation officer shall ensure that all seized parts from the kill are turned over to the local HTO. The cleaning and drying of the hide is the responsibility of the HTO because the HTO retains the hide. In all cases, the hides in question must be properly stored, preserved, and returned to the HTO as soon as possible to prevent damage and loss of economic revenue.

If there is any dispute about the distribution of the hide, meat, or parts of the bear from a DLPK, the decision is deferred to the appropriate RWO. There is no payment to the HTO or the hunter for samples, or for cleaning and drying the hide of a bear taken illegally. As per the *Nunavut Wildlife Act*, all seized parts from bears taken illegally are disposed of as directed by the judicial authority.

The following objectives are aimed at reducing bear-human conflict, and reducing human injury and mortality:

- Continue to support communities in the development and implementation of polar bear monitoring and safety plans;
- Hire, train, and equip more community polar bear monitors;
- Continue to develop and improve methods for protecting people, property, and meat caches;
- Ensure that the Department of Environment Wildlife Damage Compensation and Wildlife Damage Prevention Programs are functional and accessible to all communities;
- Enhance communication and information sharing with communities about public safety, polar bear deterrence, and available compensation programs;
- Develop and deliver education programs in schools and communities on methods to protect people while polar bears are on land;
- Work with communities and HTOs to improve local storage for meat in camps and communities as part of the bear-human conflict prevention program.

8.5 Working together (*Piliriqatiginniig*); objectives

8.5.1 Within Nunavut

This plan was developed with the direction of a co-management working group and the participation of all HTOs and communities. This is a positive step in improved cooperative management, and the following objectives will help to further improve co-management within Nunavut:

- Involve Inuit in research, including project design, field surveys, analysis, and reporting;
- Improve on the documentation of Inuit Qaujimajatuqangit about polar bears so that it is accessible for use in management decision-making.

8.5.2 Between jurisdictions

Working together should also take place at the inter-jurisdictional level. Polar bear inter-jurisdictional agreements should be developed for all subpopulations that are shared with Nunavut. Such agreements already exist between Canada, Nunavut, and Greenland (Kane Basin, Davis Strait, and Baffin Bay subpopulations). User-to-user groups should also pursue agreements on shared populations; one such agreement already exists in the western portion of the Kitikmeot and the Inuvialuit in NWT for the Northern Beaufort Sea and Viscount Melville Sound subpopulations.

The following objectives will help to foster improved inter-jurisdictional cooperation:

- Foster user-to-user agreements between Inuit organizations and other jurisdictions;
- Work toward developing compatible management regimes for shared populations;
- Build cooperative research programs in areas such as population monitoring, contaminants monitoring, and Inuit Qaujimajatuqangit studies;
- Continue to improve coordination between different levels of government and partners. Environment and Climate Change Canada, Parks Canada Agency, Department of Environment, RWOs and HTOs all have a role and an interest in implementation of this plan and the sustainable management of polar bears;
- Work with other jurisdictions in Canada to address public safety concerns and formulate coordinated responses;
- Work toward joint decision-making processes involving all the co-management boards linked to a shared subpopulation.

8.5.3 Sharing information and knowledge

Ensuring that knowledge and information are shared will help all co-management partners to make better informed decisions. Currently, information flow is sporadic,

and all parties need to make improvements. This is best done by formalizing information sharing through communications and outreach, including:

- Develop a communications strategy for sharing information;
- Develop data sharing agreements with other agencies and jurisdictions;
- Ensure that the results of studies, both scientific and Inuit Qaujimajatuqangit, are shared with all co-management partners;
- Continue to contribute to the Polar Bear-Human Interaction Management System, work with the human-bear conflict subcommittee of the Range States and outside organizations to quantify and characterize successful polar bear deterrent measures.

9. IMPLEMENTATION OF THE PLAN

Achieving the objectives identified in section 8 will require cooperation of co-management partners, jurisdictions, and significant investment of financial and human resources. New information will be presented to the NWMB when available, along with a review of the management objective(s) for the subpopulation and a review of any new scientific or Inuit Qaujimajatuqangit information. When new information is available, a change to the TAH will be recommended that is consistent with the subpopulation management objective and the objectives of this plan.

The co-management structure in Nunavut requires an NWMB decision for any changes to TAHs, management objectives, or NQLs. It is difficult to predetermine which action(s) will be undertaken within the co-management framework and the NWMB decision-making process, as each individual scenario will have its own set of circumstances. The management objectives, Inuit Qaujimajatuqangit, population size and trend, and population projections under differing harvest scenarios, will vary by subpopulation. This does not mean that action will not be taken, as the goal of the management plan is *"To maintain viable and healthy polar bear subpopulations capable of sustaining harvesting needs for current and future generations, and to ensure that polar bears remain an integral and functioning part of the ecosystem while monitored, sustainable harvests occur."* In that context, the following are examples identified by co-management partners of what actions should be taken to implement this plan. It is important to note that appropriate consultation and dialogue with co-management partners will be carried out before any action is taken.

Prior to action being taken, there will be appropriate consultation and neighbouring jurisdictions.

1035 **9.1 Harvest Management**

Management Action	Priority	Timeline
Undertake a review of the sustainable removal rates for females for all subpopulations in Nunavut.	High	3 years
Revise the Flexible Quota System to accommodate the switch from two male for every female to one male for every female sex-selective harvest ratio.	High	1 year
Monitor and evaluate the implementation of the one male for every female (1:1) sex-selective harvest ratio within the Flexible Quota System, including any impact on abundance, cub and female survival.	High	2 years
Expand and increase harvest sample collection and reporting upon peer review of research objectives.	High	5 years
Improve handling of hides taken from bears killed in defense of life and property to ensure no loss in hide value.	High	Ongoing
Ensure harvest reporting and sample submission is adequate to address research and management needs.	High	Ongoing
Develop a community program to train Inuit to effectively collect biological data on polar bear and harvest efforts.	Medium	5 years

1036

1037 **9.2 Information and Knowledge Gathering (Qanuqtuurniq): Actions**

1038 Habitat Management and Environmental Stewardship (*Avatitinnik Kamatsiarniq*):
 1039 Actions

Management Action	Priority	Timeline
Develop a knowledge and information sharing framework for co-management partners.	High	2 years
Document Inuit Qaujimajatuqangit about polar bear health, abundance, and distribution to support management decisions.	High	Ongoing
Use available Inuit Qaujimajatuqangit to support polar bear science research and formulation of management objectives.	High	Ongoing
Strive for meaningful involvement of Inuit in all aspects of polar bear research and decision-making.	High	Ongoing
Conduct population assessments as per the	High	Ongoing

inventory schedule and make the results publicly available on time.		
Continue to develop, evaluate, and apply research techniques that will provide the essential information with minimal impacts on polar bears.	Medium	Ongoing
Develop a twenty-five-year research strategy for polar bear ecosystem-based monitoring identifying and prioritizing research gaps.	Medium	2019
Build partnerships with external researchers and governments to increase Department of Environment's capacity for both science and Inuit Qaujimajatuqangit towards the implementation of the twenty-five-year research strategy.	Medium	Ongoing
Work with relevant partners to improve knowledge of the distribution and abundance polar bear prey species (mainly ringed seal and bearded seal).	Medium	5 years

9.3 Habitat Management and Environmental Stewardship (*Avatitinnik Kamatsiarniq*) Actions

Management Action	Priority	Timeline
Seek to build capacity in all co-management organizations to better participate in regulatory review processes.	Medium	Ongoing
Continue to participate in the contaminants monitoring program for polar bears.	Medium	Ongoing
Study effects of marine shipping and develop of mitigation measures.	Medium	10 years
Develop and circulate best management practices to reduce the impacts of human activities, such as tourism and mineral exploration, within polar bear habitat.	Medium	Ongoing
In general, work closely with relevant partners to reduce the impacts of climate change on polar bear habitat.	Low	10 years

9.4 People and Bears (*Inuillu Nanuillu*) Actions

Management Action	Priority	Timeline
Seek program funding to train and equip bear guards.	High	Ongoing
Develop educational material (e.g., posters, fact	High	Within 2 years

sheets, website material) for communities, tourists, mining camps, etc., on best practices to minimize human-bear interactions.		
Develop, adopt, and implement community bear management plans and community human-bear-interaction protocols.	High	Within 3 years
Encourage community-level participation to address public safety concerns using non-lethal polar bear deterrents methods such as bear guards, auditory/pyrotechnic deterrents, and fortification of meat caches.	High	Ongoing
Develop a communications plan and education materials for bear safety.	Medium	Within 3 years
Conduct a review of Damage Compensation and Damage Prevention Programs.	Medium	Within 3 years

9.5 Working Together (*Piliriqatiginniiq*) Actions

Management Action	Priority	Timeline
Seek cooperative research partners to build further capacity in Inuit Qaujimajatuqangit studies and scientific research.	High	Ongoing
Build capacity in HTOs to provide support and participation in research projects.	High	Within 3 years
Develop a knowledge and information sharing framework for co-management partners.	High	2 years
Identify inter-jurisdictional agreements near completion and ensure resources are available to finalize.	High	Ongoing
Explore frameworks for coordinated responses with other jurisdictions in Canada regarding human safety.	Medium	2 years
Identify inter-jurisdictional agreements that need to be pursued and ensure resources are available to initiate.	Medium	3 years
Explore research agreements with neighboring jurisdictions for shared populations.	Medium	5 years
Improve cooperation with federal agencies such as Parks Canada Agency and Canadian Wildlife Service so that their land management efforts also support this plan.	Medium	5 years

10. PLAN REVIEW

This management plan is meant to be a dynamic, living document and is expected to be revised as new science and Inuit Qaujimajatuqangit becomes available to ensure that the goal and objectives are met. A co-management working group will conduct a review of objectives with respect to progress made every five years. Where objectives have been met, they will be revised according to current needs. Where objectives have not been met, additional actions and new timelines may be identified. Co-management is an ongoing effort that evolves in line with available knowledge and information. The review will consider the number of polar bears in each subpopulation, their health, trends (population, reproduction, survival rates etc.), conservation of habitat (largely the sea ice, but also denning areas), reduction of human-bear conflict occurrences and resulting decrease in DLPKs, and the incorporation of Inuit Qaujimajatuqangit.

11. APPENDICES

Appendix A – Subpopulations and Status

Globally, polar bears are divided into 19 subpopulations for management purposes. This is based on movement patterns estimated from satellite telemetry data, and ear tags returned from harvested bears. The eleven subpopulations that occur in Nunavut (wholly or in-part) are presented here along with a brief characterization of their population history, status, and proposed management recommendation(s). Although these boundaries are accepted for management purposes, frequent movement of bears occur between subpopulations and both scientists and Inuit Qaujimajatuqangit believe these subpopulations are not isolated. For underlying details of estimates and trend, consult the most recent PBTC status table¹⁰.

Appendix A I – Baffin Bay (BB) subpopulation status

Brief history

The Baffin Bay subpopulation is shared between Canada (Nunavut) and Greenland. The Canada-Greenland Joint Commission was established in 2009 with the signing of a *Memorandum of Understanding between Canada, Nunavut, and Greenland to conserve and managed shared polar bear populations*. This subpopulation shares its boundaries with Kane Basin, Lancaster Sound, Foxe Basin, and Davis Strait. A study using microsatellite markers found no significant genetic differences between polar bears in the Baffin Bay and Kane Basin, but there was significant genetic variation between Baffin Bay and Davis Strait. Studies conducted between 1994 and 1997 produced a Baffin Bay subpopulation abundance estimate of 2,074 polar bears. A 3-year genetic mark-recapture survey (via biopsy darting) completed in 2014 produced a subpopulation estimate of 2,826 polar bears (range: 2,059-3,593). The trade ban placed on the subpopulation in 2010 because of perceived over-harvesting was lifted in 2016.

Status: 2,826 bears (2016)
Science – Stable

¹⁰ The status table presents the population status and trends of all polar bear subpopulations in Canada. It is reviewed annually by the Polar Bear Technical Committee (PBTC) and presented to the Polar Bear Administrative Committee (PBAC) to support management decision making.

Inuit Qaujimajatuqangit – Increased
Current TAH (2018) – Nunavut 80
– Greenland 80

Management recommendations:

- Maintain current population abundance and review management objective(s) and TAH when new Inuit Qaujimajatuqangit or scientific knowledge becomes available.
- Consider adaptively managing the subpopulation for a decrease if there is evidence (Inuit Qaujimajatuqangit or scientific knowledge) that the subpopulation size is stable or increasing and public safety becomes a major concern.
- Explore the possibility to re-assess the subpopulation boundary between Baffin Bay and Kane Basin.
- Increase cooperation with the Government of Greenland to ensure a sustainable harvest.

Appendix A II – Davis Strait (DS) subpopulation status

Brief history

The Davis Strait subpopulation is shared with Greenland, Newfoundland and Labrador, and Quebec. Studies have shown that polar bears from the northern portions of Davis Strait and those from Foxe Basin are closely related. The current abundance estimate of 2,158 bears (range: 1,833–2,542) is based on physical mark-recapture data collected in 1974–2004 and 2005–2007, and harvest data from 1974–2009. The population is characterized by low recruitment rates and high population density where sea-ice conditions are deteriorating and variable. Previously the subpopulation abundance was estimated at 900 polar bears. This estimate was based on the sum of separate estimates from southeast Baffin Island and Labrador in the 1980s. In 1993, the estimate was revised to 1,400 bears and then to 1,650 in 2005. These increases were to account for the offshore bears not surveyed, and to include Inuit Qaujimajatuqangit that suggested more bears had been seen over the last 20 years. In 2017 and 2018, a genetic mark-recapture survey of the Davis Strait subpopulation was conducted collaboratively by Nunavut, Newfoundland and Labrador, and Quebec. Concurrently, Inuit Qaujimajatuqangit studies in Nunavut, Nunavik, and Nunatsiavut are ongoing.

Status: 2,158 bears (2007)

Science – Stable
Inuit Qaujimajatuqangit – Increasing
Current TAH – Nunavut = 61
– Nunavik = 32
– Nunatsiavut = 12
– Greenland = 3
– Greenland = 3

Management recommendations:

- Maintain current population abundance and review management objective(s) and TAH when new Inuit Qaujimajatuqangit or scientific knowledge becomes available.
- Consider adaptively managing the subpopulation for a decrease if there is evidence (Inuit Qaujimajatuqangit or scientific knowledge) that the subpopulation size is stable or increasing and public safety becomes a major concern.
- Explore the possibility to re-assess the boundary between Foxe Basin and Davis Strait near Kimmirut.
- Increase cooperation among all jurisdictions that share this subpopulation to ensure a sustainable harvest.
- Hold joint co-management board public hearings to consider management options.
- Encourage inter-jurisdictional discussions between user groups to identify appropriate quota allocation between regions.

Appendix A III – Southern Hudson Bay (SH) subpopulation status

Brief history

The range of the Southern Hudson Bay subpopulation includes the Nunavik and Eeyou Marine regions and the coastline of Ontario and Québec. Polar bears in the Southern Hudson Bay, Davis Strait, and Foxe Basin subpopulation experience a seasonally ice-free environment, which forces the bears onto shore during late summer, where they remain for several months while awaiting freeze-up. Mark-recapture studies conducted 1984–86 and 2003–05 and an intensive aerial survey conducted 2011–12 suggested abundance was unchanged since the mid-1980s. A recent mark-recapture study suggested that the abundance declined by 17% from 943 bears (range: 658–1350) in 2011/2012 to 780 bears (range: 590–1029) in 2016. A concurrent Inuit knowledge study concluded that the abundance of Southern

Hudson Bay polar bears has increased relative to the 1970s and that most bears are in good body condition. An inter-jurisdictional Southern Hudson Bay Polar Bear Management Advisory Committee was established in 2018 to develop and recommend sustainable management options using best available Inuit Qaujimajatuqangit and scientific knowledge. These studies and more recent telemetry data show seasonal fidelity to the Ontario coast during the ice-free season, and some mixing with the Western Hudson Bay and Foxe Basin subpopulations during winter months.

Status: 780 bears (2016)

Science – likely decline

Inuit Qaujimajatuqangit – increased

Current TAH – Nunavut = 25 (Voluntary agreement reduced it to 20; expired 2016)

– Ontario = 3

– Nunavik = 23

Management recommendations:

- Maintain current population abundance and review management objective(s) and TAH when new Inuit Qaujimajatuqangit or scientific knowledge becomes available.
- Increase cooperation among all jurisdictions that share this population to ensure a sustainable harvest.
- Continue with inter-jurisdictional user-to-user discussions to ensure agreement on the fair allocation of the TAH.

Appendix A IV – Western Hudson Bay (WH) subpopulation status

Brief history

The Western Hudson Bay subpopulation is shared with Manitoba. This subpopulation shares its boundaries with Foxe Basin and Southern Hudson Bay. Mapping of satellite telemetry data indicates substantial range overlap in the winter when bears are on the sea ice. Inuit Qaujimajatuqangit indicates that the subpopulation's abundance has increased when compared to historic levels in the 1950s and 1970s. The 2016 aerial survey resulted in an abundance estimate of 842 bears (range: 562–1121). This estimate was not statistically different from the 2011 aerial survey estimate of 1030 bears, that used similar survey methods and was considered broadly consistent with Environment and Climate Change Canada's 2011 estimate of 806 polar bears—based on analysis of long-term capture and harvest data. All three studies combined suggest that the abundance remained stable during the past 10 years. However, like observations from the 2011 survey, cubs-of-the-year

and yearlings comprised a small proportion of the sample size in 2016, a possible indication of low recruitment.

Status: 842 bears (2016)

Science – likely declined

Inuit Qaujimajatuqangit – increased

current TAH – Nunavut = 38

– Manitoba = 4

Management recommendations:

- Maintain current population abundance and review management objective(s) and TAH when new Inuit Qaujimajatuqangit or scientific knowledge becomes available.
- Consider adaptively managing the subpopulation for a decrease if there is evidence (Inuit Qaujimajatuqangit or scientific knowledge) that the subpopulation size is stable or increasing and public safety becomes a major concern.
- Increase cooperation with Manitoba especially in the areas of tourism, polar bear deterrence and public safety.
- Explore the possibility to re-assess the management boundaries between Western Hudson Bay and Foxe Basin/Southern Hudson Bay subpopulations.
- Encourage knowledge exchange between Inuit and researchers.

Appendix A V – Foxe Basin (FB) subpopulation status

Brief history

The Foxe Basin polar bear subpopulation is shared between Nunavut and Quebec. The 2009–2010 aerial surveys produced a subpopulation estimate of 2,580 polar bears (range: 2096–3189). This estimate was not statistically different from the 1994 abundance estimate of 2,197 polar bears, derived from a tetracycline biomarking study, indicating a stable population. Inuit Qaujimajatuqangit maintains that the number bears in the subpopulation has increased. The winter home range of the Foxe Basin subpopulation overlaps with that of the Western Hudson Bay and Davis Strait. The coverage and quality of sea-ice habitat has declined substantially over the last several decades and is predicted to continue to decline. However, there is no evidence to suggest that polar bears have been negatively affected.

Status: 2,580 bears

Science – stable

Inuit Qaujimajatuqangit – increased

Current TAH – Nunavut = 123

– Nunavik = 7

Management recommendations :

- Maintain current population abundance and review management objective(s) and TAH when new Inuit Qaujimajatuqangit or Scientific knowledge becomes available.
- Consider adaptively managing the subpopulation for a decrease if there is evidence (Inuit Qaujimajatuqangit or scientific knowledge) that the subpopulation size is stable or increasing and public safety becomes a major concern.
- Increase cooperation with Nunavik to ensure sustainable harvesting.
- Hold joint board hearings and meetings with Nunavik Marine Region Wildlife Board (NMRWB).

Appendix A VI – Gulf of Boothia (GB) subpopulation status

Brief history

Based on Inuit Qaujimajatuqangit, a recognition of sampling deficiencies, and polar bear densities in other areas, an interim subpopulation estimate of 900 was established in the 1990s. A physical mark-recapture study from 1976–2000 produced an abundance estimate of 1,592 polar bears range (1231–1953). This study also suggested that recruitment levels are high and the population is stable or increasing. A new three-year subpopulation abundance study that began in 2015 was finalised in 2017. Results of the abundance estimate are expected in 2019.

Status: 1,592 bears (2000)

Science –uncertain

Inuit Qaujimajatuqangit – increased

Current TAH – Nunavut = 74

Management recommendations:

- Maintain current population abundance and review management objective(s) and TAH when new Inuit Qaujimajatuqangit or Scientific knowledge becomes available.

Appendix A VII – M’Clintock Channel (MC) subpopulation status

Brief history

An estimate of 900 bears was derived from a six-year study undertaken in the mid-1970s. Following the completion of a mark-recapture inventory in the spring of 2000, the subpopulation was estimated to number 284 (range: 166-402). A moratorium was put in place, followed by a significantly reduced harvest that was in place until 2015/16 when the TAH was increased. The management objective for this population is an increase in the abundance for recovery. Inuit suggest that there has been a recovery in the number of bears in the subpopulation. They also consider the current population estimate of 900 bears to be "about right". The Department of Environment conducted a genetic mark-recapture study from 2014-2017; results are expected in 2019.

Status: 284 bears (2000)

Science – uncertain, but likely increasing

Inuit Qaujimajatuqangit – increased

Current TAH – Nunavut = 12

Management recommendations:

- Maintain current population abundance and review management objective(s) and TAH when new Inuit Qaujimajatuqangit or scientific knowledge becomes available.

Appendix A VIII – Lancaster Sound (LS) subpopulation status

Brief history

Information from satellite radio-collars, and physical and genetic mark-recapture show that this subpopulation is distinct from the adjoining Viscount Melville Sound, M’Clintock Channel, Gulf of Boothia, Baffin Bay, and Norwegian Bay subpopulations. The subpopulation estimate of 2,541 (range: 2932–2150) was based on an analysis of both historical and current mark-recapture data up to 1997. This estimate is considerably larger than a previous estimate of 1,675 that included Norwegian Bay. Currently, there are no data available to assess the population size.

Status: 2,541 bears (1998)

Science – uncertain, likely stable

Inuit Qaujimajatuqangit – increased

Current TAH – Nunavut = 85

Management recommendations:

- Maintain current population abundance and review management objective(s) and TAH when new Inuit Qaujimajatuqangit or scientific knowledge becomes available.

Appendix A IX – Kane Basin (KB) subpopulation status

Brief history

The Kane Basin polar bear subpopulation is inter-jurisdictional and internationally shared between Canada (Nunavut) and Greenland. Like Baffin Bay, management of the Kane Basin polar bears is coordinated by the Canada-Greenland Joint Commission. Kane Basin polar bears are not genetically different from those in the adjacent Baffin Bay subpopulation. A two-year (2013–2014) collaborative study between Greenland and Nunavut estimated that there are 357 bears in the Kane Basin subpopulation (range: 221–493. This estimate is higher than the 1997 estimate of 164 polar bears and when taken together with survival rates and body conditions, suggests an increase in numbers. The study, and a subsequent Harvest Risk Assessment showed that there are fewer males than females in the subpopulation, male survival is lower than female survival, and found no evidence that Kane Basin polar bears have been negatively affected by a decrease in sea ice extent over the past several decades.

Status: 357 bears (2014)

Science – increased

Inuit Qaujimajatuqangit – increased

Current TAH – Nunavut = 5

Greenland = 9

Management recommendations:

- Maintain current population abundance and review management objective(s) and TAH when new Inuit Qaujimajatuqangit or scientific knowledge becomes available.
- Explore the possibility to re-assess the population boundary between Baffin Bay and Kane Basin.
- Work closely with Greenland to ensure that a sustainable harvest occurs.

Appendix A X – Norwegian Bay (NW) subpopulation status

Brief history

The current (1993–97) estimate is 203 (range: 159–247). Data collected during mark-recapture studies and from satellite radio tracking of adult female polar

bears indicate that most of the polar bears in this subpopulation are concentrated along the coastal tide cracks and ridges along the north, east, and southern boundaries of the management unit. Science research suggests that the low polar bear abundance may be due to low ringed seal productivity in the central and western areas of Norwegian Bay—a result of prevailing multi-year ice¹¹. This subpopulation is genetically distinct compared to other polar bear subpopulations.

Status: 203 bears (1998)

Science – uncertain

Inuit Qaujimajatuqangit – stable

current TAH – Nunavut = 4

Management recommendations:

- Maintain current population abundance and review management objective(s) and TAH when new Inuit Qaujimajatuqangit or scientific knowledge becomes available.

Appendix A XI – Viscount Melville Sound (VM) subpopulation status

Brief history

The Viscount Melville Sound subpopulation is shared with the Inuvialuit Settlement Region, in the Northwest Territories. The current subpopulation estimate of 161 polar bears was based on a mark-recapture survey completed in 1992. Results of a mark-recapture study conducted by the Government of Northwest Territories are expected in 2019.

Status: 161 bears (1992)

Science – uncertain

Inuit Qaujimajatuqangit – increasing

Current TAH – Nunavut = 3

– Northwest Territories = 4

¹¹ Kingsley, M. C. S., Stirling, I., Calvert, W. 1985. The distribution and abundance of seals in the Canadian High Arctic, 1980–82. *Can. J. Fish. Aquat. Sci.* **42**: 1189-1210, pp 1207.

McLoughlin, P. D., Taylor, M. K., Dowsley, M. 2007. Update, COSEWIC status report on the polar bear (*Ursus maritimus*) prepared for the Committee on the Status of Endangered Wildlife in Canada. Government of Nunavut, Department of Environment, Status report: **32**, Iqaluit, pp 20.

Management recommendations:

- Maintain current population abundance and review management objective(s) and TAH when new Inuit Qaujimajatuqangit or scientific knowledge becomes available.
- Increase cooperation with the Inuvialuit Settlement Region and the Government of Northwest Territories to ensure a sustainable harvest.

Appendix A XII – Northern Beaufort Sea (NB) subpopulation status

Brief history

It is currently recognised that the 2006 estimate of 980 bears was biased low because of changes in distribution. The subpopulation estimates of 1200-1300 in 2004 and 2005 appears to more accurately reflect the current number of bears in the population, suggesting that the population is increasing. The Inuvialuit Settlement Region adopts a subpopulation estimate of 1,710, for management purposes.

Status: 980 bears (2006)

Science – stable

Inuit Qaujimajatuqangit – stable

current TAH – Nunavut = 6

– NWT = 71

Management recommendations:

- Maintain current population abundance and review management objective(s) and TAH when new Inuit Qaujimajatuqangit or scientific knowledge becomes available.
- Increase cooperation with the Inuvialuit Settlement Region and the Government of Northwest Territories to ensure a sustainable harvest.

Appendix B – Research Schedule

Proposed schedule to conduct studies to update the status of the population, using scientific Inuit Qaujimajatuqangit, as of December 2018. This schedule is tentative and assumes full availability of funds and human resources. The priorities and needs may shift over the coming years, which will affect timing of this schedule. TBD-To be determined

Subpopulation	Previous survey year and method	Next survey year and method	Previous IQ survey	Proposed IQ survey
Baffin Bay	2011–2013 Genetic mark-recapture	2021 To be determined	2015	2022
Davis Strait	2005–2007 Mark-recapture	2017–18 Genetic mark-recapture	2007-2008	2018
Foxe Basin	2010–2011 Aerial survey	2020 Aerial survey	2008-2009	2020
Gulf of Boothia	1998–2000 Mark-recapture	2015–2017 Genetic mark-recapture	n/a	TBD
Kane Basin	2012–2014 Genetic mark recapture and aerial survey	2021 To be determined	n/a	2024
Lancaster Sound	1997 Mark-recapture	2019–2021 To be determined	n/a	2020
M'Clintock Channel	1998-2000 Mark-recapture	2014-2017 Genetic mark recapture	2002-2006	TBD
Northern Beaufort Sea	2006 Mark-recapture	2019	n/a	TBD
Norwegian Bay	1998 Mark-recapture	2019–2021 To be determined	n/a	2020
Southern Hudson Bay	2016 Aerial survey	2021	2013	TBD
Viscount Melville	2012–2014 Mark-recapture	TBD	n/a	TBD
Western Hudson Bay and Southern Hudson Bay	2016 Aerial survey	2021 Aerial survey	2011-2012	2021

Appendix C – Literature Reviewed

- Amstrup, S. C. 1993. Human disturbances of denning polar bears in Alaska. *Arctic*, **46**: 246-250.
- Amstrup, S. C. 2003. Polar bear. Pp. 587–610 in Wild mammals of North America: biology, management, and conservation. 2nd Edition. G.A. Feldhamer, B.C. Thompson, and J.A. Chapman (eds). John Hopkins University Press, Baltimore, MD.
- biology, management, and conservation. 2nd Edition. G. A.
- Amstrup, S. C., Durner, G. M., McDonald, T. L., Johnson, W. R. 2006. Estimating potential effect of hypothetical oil spills on polar bears. US Geological Survey, US Department of the Interior. 55 pp.
- Atkinson, S. N., Nelson, R. A., Ramsay, M. A. 1996. Changes in the body composition of fasting polar bears (*Ursus maritimus*): the effect of relative fatness on protein conservation. *Physiol. Zool.* **69**: 304-316.
- Atkinson, S., Garshelis, D., Stapleton, S., Hedman, D. 2012. Western Hudson Bay polar bear aerial survey, 2011. Government of Nunavut, Final Report, Igloolik, Nunavut. 56 pp.
- Best, R. C. 1984. Digestibility of ringed seals by the polar bear. *Can. J. Zool.* **63**: 1033-1036.
- Bethke, R., Taylor, M. K., Amstrup, S., Messier, F. 1996. Population delineation of polar bears using satellite collar data. *Ecol. Appl.* **6**: 311-317.
- Blix, A. S., Lentfer, J. W. 1979. Modes of thermal protection in polar bear cubs – at birth and on emergence from their den. *Am. J. Physiol.* **236**: R67-R74.
- Brice-Bennett, C. 1977. Land Use in the Nain and Hopedale Regions. Pp 97-203 in Our footprints are everywhere, Inuit land use and occupancy in Labrador. C. Brice-Bennett (ed.). Labrador Inuit Association, Nain, Greenland.
- Bytingsvik, J., Lie, E., Aars, J., Derocher, A. E., Wiig, Ø., Jenssen, B. M. 2012. PCBs and OH-PCBs in polar bear mother-cub pairs : a comparative study based on plasma levels in 1998 and 2008. *Sci. Total Env.* DOI: 10.1016/j.scitotenv.2011.12.033.

- Campagna, L., Van Coeverden de Groot, P.J., Saunders, B., Atkinson, S., Weber, D., Dyck, M.G., Boag, P.T., Loughheed, S.C. 2013. Extensive sampling of polar bears (*Ursus maritimus*) in the Northwest Passage (Canadian Arctic Archipelago) reveals population differentiation across multiple spatial and temporal scales. *Ecol. Evol.* **3**: 3152-3165.
- Clark, D. A., Stirling, I., Calvert, W. 1997. Distribution, characteristics, and use of earth dens and related excavations by polar bears on the western Hudson Bay Lowlands. *Arctic*, **50**: 158-166.
- Colborn, T., vom Saal, F. A., Soto, A. M. 1993. Developmental effects of endocrine-disrupting chemicals in wildlife and humans. *Environ. Health Perspect.* **101**: 378-384.
- Comiso, J. C., Nishio, F. 2008. Trends in sea ice cover using enhanced and compatible AMSR-E, SSM/I, and SMMR data. *J. Geophys. Res.-Oceans* **113**: C020507.
- Damstra, T., Barlow, S. Bergman, A., Kavlock, R., Kraak, G. V. D. 2002. Global Assessment of the state-of-the-science of endocrine disruptors. Geneva: World Health Organization.
- de March, B. G. E., de Wit, C., Muir, D. C. G., Braune, B., Gregor, D. J., Norstrom, R. J. 1998. Persistent organic pollutants. Pp. 183-372 in AMAP Assessment Report: Arctic Pollution Issues. Oslo: Arctic Monitoring Assessment Programme.
- DeMaster, D. P., Stirling, I. 1981. *Ursus maritimus*. Polar bear. *Mammal. Spec.* **145**: 1-7.
- Department of Environment. 2014. Summary of Community Consultations on the draft Nunavut Polar Bear Management Plan development and process. Government of Nunavut, Iqaluit, Nunavut.
- Derocher, A. E., Stirling, I., Andriashek, D. 1992. Pregnancy rates and serum progesterone levels of polar bears in western Hudson Bay. *Can. J. Zool.* **70**: 561-566.
- Derocher, A. E., Andriashek, D., Stirling, I. 1993. Terrestrial foraging by polar bears during the ice-free period in western Hudson Bay. *Arctic*, **46**: 251-254.

- 1514
1515 Derocher, A. E., Stirling, I. 1995. Temporal variation in reproduction and body
1516 mass of polar bears in western Hudson Bay. *Can. J. Zool.* **73**: 1657-1665.
1517
- 1518 Derocher, A. E., Stirling, I. 1998. Geographic variation in growth of polar bears
1519 (*Ursus maritimus*). *J. Zool. (Lond.)* **245**: 65-72.
1520
- 1521 Derocher, A. E., Stirling, I. 1998. Maternal investment and factors affecting
1522 offspring size in polar bears (*Ursus maritimus*). *J. Zool. (Lond.)* **245**: 253-260.
1523
- 1524 Derocher, A. E., Wiig, Ø. 1999. Infanticide and cannibalism of juvenile polar
1525 bears (*Ursus maritimus*) in Svalbard. *Arctic*, **52**: 307–310.
1526
- 1527 Derocher, A. E., Wiig, Ø., Bangjord, G. 2000. Predation of Svalbard reindeer by
1528 polar bears. *Polar Biol.* **23**: 675-678.
1529
- 1530 Derocher, A. E., Wolkers, H., Colborn, T., Schlabach, M., Larsen, T. S. & Wiig, O.
1531 2003. Contaminants in Svalbard polar bear samples archived since 1967 and
1532 possible population level effects. *Sci. Total Environ.* **301**: 163-174.
1533
- 1534 Donaldson, G. M., Chapdelaine, G., Andrews, J. D. 1995. Predation of thick-
1535 billed murres, *Uria lomvia*, at two breeding colonies by polar bears, *Ursus*
1536 *maritimus*, and walruses, *Odobenus rosmarus*. *Can. Field-Nat.* **109**: 112-114.
1537
- 1538 Dowsley, M., Wenzel, G. W. 2008. “The time of the most polar bears”: A co-
1539 management conflict in Nunavut. *Arctic*, **61**: 177–189.
1540
- 1541 Durner, G. M., D. C. Douglas, R. M. Nielson, et al. 2009. Predicting 21st-century
1542 polar bear habitat distribution from global climate models. *Ecological*
1543 *Monographs*, **79**: 25–58.
1544
- 1545 Dyck, M. G., Daley, K. 2002. Cannibalism of a yearling polar bear (*Ursus*
1546 *maritimus*) at Churchill, Canada. *Arctic*, **55**: 190-192.
1547
- 1548 Dyck, M. G. Baydack, R. K. 2004. Vigilance behaviour of polar bears in the
1549 context of wildlife-viewing activities at Churchill, Manitoba, Canada. *Biol. Cons.*
1550 **116**: 343-350.
1551
- 1552 Dyck, M. G. 2006. Characteristics of polar bears killed in defence of life and
1553 property in Nunavut, Canada, 1970-2000. *Ursus*, **17**: 52-62.
1554

- Dyck, M. G., Baydack, R. K. 2006. Human activities associated with polar bear viewing near Churchill, Manitoba, Canada. *Human Dimensions of Wildlife*, **11**: 143-145.
- Dyck, M. G., Romberg, S. 2007. Observations of a wild polar bear (*Ursus maritimus*) successfully fishing Arctic charr (*Salvelinus alpinus*) and fourhorn sculpin (*Myoxocephalus quadricornis*). *Polar Biol.* **30**: 1625-1628.
- Dyck, M. G., Morin, P. 2011. In vivo digestibility trials of a captive polar bear (*Ursus maritimus*) feeding on harp seal (*Pagophilus groenlandicus*) and Arctic charr (*Salvelinus alpinus*). *Pakistan J. Zool.* **43**: 759-767.
- Feldhamer, G. A., Thompson, B. C., Chapman, J. A. (eds). Wild mammals of North America. John Hopkins University Press, Baltimore, MD.
- Ferguson, S. H., Taylor, M. K., Messier, F. 2000. Influence of sea ice dynamics on habitat selection by polar bears. *Ecology*, **81**: 761-772.
- Ferguson, S. H., Taylor, M. K., Rosing-Asvid, A., Born, E. W., Messier, F. 2000. Relationships between denning of polar bears and conditions of sea ice. *J. Mammal.* **81**: 1118-1127.
- Fikkan, A., Osherenko, G., and Arikainen, A. 1993. Polar bears: the importance of simplicity. Pp. 96-151 in Young, O. R., and Osherenko, G. (eds). Polar politics: creating international environmental regimes. Ithaca, NY: Cornell University Press.
- Freeman, Milton M.R. and Lee Foote, 2009. Inuit, Polar Bears and Sustainable Use. Edmonton, CCI Press, 252 pages.
- Freeman, M. M. R. 2001. Culture, commerce and international co-operation in the global recovery of polar bears. *Pacific Conservation Biology* **7**: 161– 168.
- Freeman, M. M. R., and Wenzel, G. 2006. The nature and significance of polar bear conservation hunting in the Canadian Arctic. *Arctic* **59**:21-30.
- Furnell, D. J., Oolooyuk, D. 1980. Polar bear predation on ringed seals in ice-free water. *Can. Field-Nat.* **94**: 88-89.
- Furnell, D.J., Schweinsburg, R.E. 1984. Population dynamics of central Arctic polar bears. *J. Wildl. Manage.* **48**: 722-728.

- Gentry, A. 2001. Nomenclatural notes: the authorship and date of the specific name of *Ursus* or *Thalarctos maritimus*, the polar bear, is Phipps (1774) and not Linnaeus (1758). *Bull. Zool. Nomen.* **58**: Part 4.
- Gough, W. A., Cornwell, A. R., Tsuji, L. J. S. 2004. Trends in seasonal sea-ice duration in southwestern Hudson Bay. *Arctic*, **57**: 299-305.
- Hamilton, S.G., Castro de la Guardia, L., Derocher, A.E., Sahanatien, V., Tremblay, B., et al. 2014. Projected polar bear sea ice habitat in the Canadian Arctic Archipelago. *PLoS ONE* 9: e113746. doi:10.1371/journal.pone.0113746
- Hannah, C.G., Dupont, F., and Dunphy, M. 2009. Polynyas and tidal currents in the Canadian Arctic Archipelago. *Arctic*, **62**: 83-95.
- Harington, C. R. 1968. Denning habits of the polar bear (*Ursus maritimus* Phipps). *Can. Wildl. Serv. Report Series No. 5*. 30 pp.
- Hobson, K. A., Stirling, I. 1997. Low variation in blood $\delta^{13}\text{C}$ among Hudson Bay polar bears: implications for metabolism and tracing terrestrial foraging. *Mar. Mammal Sci.* **13**: 359-367.
- Hobson, K. A., Stirling, I., Andriashek, D. S. 2009. Isotopic homogeneity of breadth CO_2 from fasting and berry-eating polar bears: implications for tracing reliance on terrestrial foods in a changing Arctic. *Can. J. Zool.* **87**: 50-55.
- Honderich, J. E. 2001. Wildlife as a hazardous resource: an analysis of the historical interaction of humans and polar bears in the Canadian Arctic 2000 B.C. to 1935 A.D. M. A. thesis, University of Waterloo, ON, Waterloo. 193 pp.
- Howell-Skalla, L. A., Cattet, M. R. L., Ramsay, M. A., Bahr, J. M. 2002. Seasonal changes in testicular size and serum LH, prolactin and testosterone concentrations in male polar bears (*Ursus maritimus*). *Reproduction*, **123**: 729-733.
- IPCC (Intergovernmental Panel on Climate Change). 2001. Third Assessment Report: Climate Change 2001 (TAR). Accessible at: <http://www.ipcc.ch>.
- IPCC (Intergovernmental Panel on Climate Change). 2007. Fourth Assessment Report: Climate Change 2007 (AR4). Accessible at: <http://www.ipcc.ch>.

- Iverson, S. J., Stirling, I., Lang, S. L. C. 2006. Spatial and temporal variation in the diets of polar bears across the Canadian Arctic: indicators of changes in prey populations and environment. Pages 98-117 in I.L. Boyd, S. Wanless, C. J. Camphuysen (eds.). Top predators in marine ecosystems. Cambridge University Press, New York, New York, USA.
- Kalxdorff, S. B. 1997. Collection of local knowledge regarding polar bear habitat use in Alaska. Marine Mammals Management, Fish and Wildlife Service, Region 7, Alaska. USFWS Technical Report MMM 97-2. U.S. Department of the Interior. 71 pp.
- Kingsley, M. C. S., Stirling, I., Calvert, W. 1985. The distribution and abundance of seals in the Canadian High Arctic, 1980–82. *Can. J. Fish. Aquat. Sci.* **42**: 1189-1210.
- Kolenosky, G. B., Prevett, J. P. 1983. Productivity and maternity denning of polar bears in Ontario. *Int. Conf. Bear Res. Manage.* **5**: 238-245.
- Kurtén, B. 1964. The evolution of the polar bear, *Ursus maritimus* Phipps. *Acta Zool. Fenn.* **108**: 130.
- Laidre, K. L. et al. 2015. Arctic marine mammal population status, sea ice habitat loss, and conservation recommendations for the 21st century. *Conservation Biology*, DOI: 10.1111/cobi.12474.
- Laidre, K. L., Stirling, I., Lowry, L. F., Wiig, Ø., Heide-Jorgensen, M. P., Ferguson, S. H. 2008. Quantifying the sensitivity of Arctic marine mammals to climate-induced habitat change. *Ecol. Appl.* **18**: S97-S125.
- Lewis, A., Doidge, W., Suppa, S. 2006. Update of traditional knowledge on polar bears at Inukjuak and Puvirnituq, Nunavik. Report 12-493 submitted to Aboriginal Species at Risk Fund, Environment and Climate Change Canada, Québec Region. Nunavik Research Centre, Makivik Corporation, Kuujuaq, QC.
- Letcher, R. J., Bustnes, J. O., Dietz, R., Jenssen, B. M., Jørgensen, E. H., Sonne, C., Verrault, J., Vijayan, M. M., Gabrielsen, G. W. 2010. Exposure and effects assessment of persistent organohalogen contaminants in Arctic wildlife and fish. *Sci Total Environ.* **408**: 2995-3043.
- Lie, E., Bernhoft, A., Riget, F., Belikov, S. E., Boltunov, A. N., Derocher, A. E.,

- Garner, G. W., Wiig, O., & Skaare, J. U. 2003. Geographical distribution of organochlorine pesticides (OCPs) in polar bears (*Ursus maritimus*) in the Norwegian and Russian Arctic. *Sci. Total Environ.* **306**: 159-170.
- Linnaeus, C. 1758. *Systema Naturae*, Ed. 10, Vol. 1. 824 pp. Salvii, Holmiae.
- Lunn, N. J., Stirling, I., Andriashek, D., Richardson, E. 2004. Selection of maternity dens by female polar bears in western Hudson Bay. *Polar Biol.* **27**: 350–356.
- Lunn, N. J., Stenhouse, G. B. 1985. An observation of possible cannibalism by polar bears (*Ursus maritimus*). *Can. J. Zool.* **63**: 1516–1517.
- Markus, T., Stroeve, J. C. and Miller J. 2009. Recent changes in Arctic sea ice melt onset, freezeup, and melt season length. *J. Geophys. Res.* 114:C12024, doi:10.1029/2009JC005436.
- Maslanik, J., Stroeve, J., Fowler, C. and Emery W. 2011. Distribution and trends in Arctic sea ice through spring 2011. *Geophys. Res. Letters* 38:L13502, doi:10.1029/2011GL047735.
- Mauritzen, M. et al. 2003. Functional responses in polar bear habitat selection. *Oikos*, **100**: 112–124.
- McLoughlin, P. D., Taylor, M. K., Messier, F. 2005. Conservation risks of male-selective harvest for mammals with low reproductive potential. *J. Wildl. Manage.* **69**: 1592-1600.
- McLoughlin, P. D., Taylor, M. K., Dowsley, M. 2007. Update, COSEWIC status report on the polar bear (*Ursus maritimus*) prepared for the Committee on the Status of Endangered Wildlife in Canada. Government of Nunavut, Department of Environment, Status report: 32, Iqaluit, 59 pp.
- McKinney, M. A., Peacock, E., Letcher, R. 2009. Sea ice-associated diet change increases the levels of chlorinated and brominated contaminants in polar bears. *Environ. Sci. Technol.* **43**: 4334-4339.
- Malenfant, R.M., Davis, C.S., Cullingham, C.I., Coltman, D.W. 2016 Circumpolar genetic structure and recent gene flow of polar bears: a reanalysis. *PLoS ONE* 11(3): e0148967. doi:10.1371/journal.pone.0148967

- Messier, F., Taylor, M. K., Ramsay, M. A. 1994. Denning ecology of polar bears in the Canadian Arctic Archipelago. *J. Mammal.* **75**: 420-430.
- Molnár, P. K., Lewis, M. A. and Derocher, A. E. 2014. Estimating allee dynamics before they can be observed: polar bears as a case study. *PLoS One* **9(1)**: e85410.
DOI:10.1371/journal.pone.0085410.
- Muir, D., Braune, B., DeMarch, B., Norstrom, R., Wagemann, R., Lockhart, L., Hargrave, B., Bright, D., Addison, R., Payne, J., Reimer, K. 1999. Spatial and temporal trends and effects of contaminants in the Canadian Arctic marine ecosystem: A review. *Sci. Total Environ.* **230**: 83–144.
- Muir, D., Backus, S., Derocher, A. E., Dietz, R., Evans, T. J., Gabrielsen, G. W., Nagy, J., Norstrom, R. J., Sonne, C., Stirling, I., Taylor, M. K., Letcher, R. J. 2006. Brominated flame retardants in polar bears (*Ursus maritimus*) from Alaska, the Canadian Arctic, East Greenland, and Svalbard. *Environ. Sci. & Technol.* **40**: 449–455.
- Norstrom, R. J., Belikov, S. E., Born, E. W., Garner, G. W., Malone, B., Olpinski, S., Ramsay, M. A., Schliebe, S., Stirling, I., Stishov, M. S., Taylor, M. K., Wiig, Ø. 1998. Chlorinated hydrocarbon contaminants in polar bears from eastern Russia, North America, Greenland and Svalbard. *Arch. Environ. Contam. Toxicol.* **35**: 354–367.
- Obbard, M. E., Cattet, M. R. L., Moody, T., Walton, L. R., Potter, D., Inglis, J., Chenier, C. 2006. Temporal trends in the body condition of Southern Hudson Bay polar bears. Climate Change Research Information Note, No. 3. Ontario Ministry of Natural Resources, Applied Research and Development Branch, Sault Ste. Marie, ON, 8 pp.
- Obbard, M. E. 2008. Southern Hudson Bay polar bear project: Final Report. Ontario Ministry of Natural Resources, Peterborough, Ontario. 64 pp.
- Obbard, M. E., Thiemann, G. W., Peacock, E., DeBruyn, T. D. (eds) (2010). *Polar Bears: Proceedings of the 15th Working Meeting of the IUCN/SSC Polar Bear Specialist Group, Copenhagen, Denmark, 29 June–3 July 2009*. Gland, Switzerland and Cambridge, UK: IUCN. vii + 235 pp.

- Obbard, M.E., Middel, K.R., Stapleton, S., Thibault, I., Brodeur, V., and Jutras, C. 2013. Estimating abundance of the Southern Hudson Bay polar bear subpopulation using aerial surveys, 2011 and 2012. Ontario Ministry of Natural Resources, Science, and Research Branch, Wildlife Research Series 2013-01.33 pp.
- Øritsland, N. A., Engelhardt, F. R., Juck, F. A., Hurst, R. J., Watts, P. D. 1981. Effect of crude oil on polar bears. Indian and Northern Affairs Canada, Environmental Studies No. 24.
- Ovsyanikov, N. G. 1996. Interactions of polar bears with other large mammals, including man. *J. Wildl. Res.* **1**: 254-289.
- Palmer, S. S., Nelson, R. A., Ramsey, M. A., Stirling, I., Bahr, J. M. 1988. Annual changes in serum sex steroids in male and female black (*Ursus americanus*) and polar (*Ursus maritimus*) bears. *Biol. Repr.* **38**: 1044-1050.
- Peacock, E., Taylor, M. K., Laake, J., Stirling, I. 2013. Population ecology of polar bears in Davis Strait, Canada and Greenland. *J. Wildl. Manage.* DOI: 10.1002./jwm.489.
- Pedersen, A. 1945. Der Eisbär: Verbreitung und Lebensweise. E. Bruun, Copenhagen.
- Perovich, D. K., Richter-Menge, J. A. 2009. Loss of ice in the Arctic. *Ann. Rev. Mar. Sci.* **1**: 417-441.
- Phipps, C. J. 1774. A voyage towards the North Pole undertaken by His Majesty's Command, 1773. viii, 253 pp., 14 pls. Nourse, London.
- Pilfold, N. W., Derocher, A. E., Stirling, I., Richardson, E., Andriashek, D. 2012. Age and sex composition of seals killed by polar bears in the eastern Beaufort Sea. PLoS ONE; DOI: 10.1371/journal.pone.0041429
- Polischuk, S. C., Letcher, R. J., Norstrom, R. J., Ramsay, M. A. 1995. Preliminary results of fasting on the kinetics of organochlorines in polar bears (*Ursus maritimus*). *Sci. Total Environ.* **160-161**: 465-472.
- Polischuk, S. C., Norstrom, R. J., Ramsay, M. A. 2002. Body burdens and tissue concentrations of organochlorines in polar bears vary during seasonal fasts.

Environ. Pollut. **118**: 29-39.

Prestrud, P., and Stirling, I. 1994. The international polar bear agreement and the current status of polar bear conservation. *Aquatic Mammals* **20**: 113-124.

Ramsay, M. A., and Dunbrack, R. L. 1986. Physiological constraints on life history phenomena: The example of small bear cubs at birth. *Am. Nat.* **127**: 735-743.

Ramsay, M.A., Stirling, I. 1988. Reproductive biology and ecology of female polar bears (*Ursus maritimus*). *J. Zool. (Lond.)* **214**: 601-634.

Ramsay, M. A., Stirling, I. 1990. Fidelity of female polar bears to winter den sites. *J. Mammal.* **71**: 233-236.

Ramsay, M. A., Hobson, K. A. 1991. Polar bears make little use of terrestrial food webs: evidence from stable-carbon isotope analysis. *Oecologia*, **86**: 598-600.

Regehr, E. V., Amstrup, S. C., Stirling, I. 2006. Polar bear population status in the southern Beaufort Sea: U.S. Geological Survey Open-File Report 2006-1337, 20 pp.

Regehr, E. V., Lunn, N. J., Amstrup, S. C., Stirling, I. 2007. Effects of earlier sea ice breakup on survival and population size of polar bears in western Hudson Bay. *J. Wildl. Manage.* **71**: 2673-2683.

Regehr, E. V., Hunter, C. M., Caswell, H., Amstrup, S.C. Stirling, I. 2010. Survival and breeding of polar bears in the southern Beaufort Sea in relation to sea ice. *J. Anim. Ecol.* **79**: 117-127.

Richardson, E., Stirling, I., Hik, D. S. 2005. Polar bear (*Ursus maritimus*) maternity denning habitat in western Hudson Bay: A bottom-up approach to resource selection functions. *Can. J. Zool.* **83**: 860-870.

Rockwell, R. F., Gormezano, L. J. 2009. The early bear gets the goose: climate change, polar bears and lesser snow geese in western Hudson Bay. *Polar Biol.* **32**: 539-547.

Rode, K.D., Amstrup, S.C. and Regehr, E.V. 2010. Reduced body size and cub recruitment in polar bears associated with sea ice decline. *Ecol. Appl.* **20**: 768-782.

- Rode, K. D., Peacock, E., Taylor, M., Stirling, I., Born, E. W., Laidre, K. L., Wiig, Ø. 2012. A tale of two polar bear populations: ice habitat, harvest, and body condition. *Popul. Ecol.* **54**: 3-18.
- Rosing-Asvid, A., Born, E. W., Kingsley, M. C. S. 2002. Age at sexual maturity of males and timing of the mating season of polar bears (*Ursus maritimus*) in Greenland. *Polar Biol.* **25**: 878-883.
- Russell, R. H. 1975. The food habits of polar bears of James Bay and southwest Hudson Bay in summer and autumn. *Arctic*, **28**: 117-129.
- Sahanatien, V., Peacock, E., and A. E. Derocher. 2015. Population substructure and space use of Foxe Basin polar bears. *Ecology and Evolution*, **5**: 2851-2864.
- Sahanatien, V., Derocher, A. E. 2012. Monitoring sea ice habitat fragmentation for polar bear conservation. *Animal Cons.* DOI : 10.1111/j.1469-1795.2012.00529
- Saunders, B. L. 2005. The mating system of polar bears in the central Canadian Arctic. M.Sc. Thesis, Queen's University, Kingston, Ontario.
- Serreze, M. C., M. M. Holland, and J. Stroeve. 2007. Perspectives on the Arctic's shrinking sea ice cover. *Science* **315**: 1533–1536
- Sonne, C., Dyck, M., Riget, F., Bech-Jensen, J.E., Hyldstrup, L., Letcher, R., Gustavson, K., Gilbert, T., and Dietz, R. 2015. Globally used chemicals and penile density in Canadian and Greenland polar bears. *Environmental Research* **137**: 287-291.
- Sonne, C., Riget, F. F., Dietz, R., Kirkegaard, M., Born, E. W., Letcher, R., Muir, D. C. G. 2005. Trends in fluctuating asymmetry in East Greenland polar bears (*Ursus maritimus*) from 1892 to 2002 in relation to organohalogen pollution. *Sci. Total Environ.* **341**: 81-96.
- Sonne, C., Leifson, P. S., Dietz, R., Born, E. W., Letcher, R. J., Hyldstrup, L., Riget, F. F., Kirkegaard, M., Muir, D. C. G. 2006. Xenoendocrine pollutants may reduce size of sexual organs in East Greenland polar bears (*Ursus maritimus*). *Environ. Sci Technol* **40**: 5668-5674.3
- Sonne, C. 2010. Health effects from long-range transported contaminants in

Arctic top predators: An integrated review based on studies of polar bears and relevant model species. *Environ Int.* **36**: 461–491.

Sou, T. and Flato G. 2009. Sea ice in the Canadian Arctic Archipelago: modeling the past (1950-2004) and the future (2041-60). *J. Climate* **22**: 2181-2198.

Smithwick, M., Mabury, S. A., Solomon, K. R., Sonne, C., Martin, J. W., Born, E. W., Dietz, R., Derocher, A. E., Letcher, R. J., Evans, T. J., Gabrielsen, G. W., Nagy, J., Stirling, I., Taylor, M. K., Muir, D. C. G. 2005. Circumpolar study of perfluoroalkyl contaminants in polar bears (*Ursus maritimus*). *Environ. Sci. & Technol.* **39**: 5517–5523.

Stapleton, S., Peacock, E., and Garshelis, D. 2016. Aerial surveys suggest long-term stability in the seasonally ice-free Foxe Basin (Nunavut) polar bear population. *Marine Mammal Science*, **32**: 181-201.

Stapleton, S., Peacock, E., Garshelis, D., Atkinson, S. 2012. Foxe Basin polar bear aerial survey, 2009 and 2010: Final Report, Government of Nunavut, Iqaluit, Nunavut.

Stapleton, S., Atkinson, S., Hedman, D., and Garshelis, D. 2014. Revisiting Western Hudson Bay: using aerial surveys to update polar bear abundance in a sentinel population. *Biol. Cons.* **170**: 38-47.

Stempniewicz, L. 2006. Polar bear predatory behavior toward molting Barnacle geese and nesting Glaucus gulls on Spitzbergen. *Arctic*, **59**: 247-251.

Stirling, I., McEwan, E. H. 1975. The caloric value of whole tined seals (*Phoca hispida*) in relation to polar bear ecology and hunting behavior. *Can. J. Zool.* **53**: 1021-1027

Stirling, I., Archibald, W. R. 1977. Aspects of predation of seals by polar bears. *J. Fish. Res. Board Can.* **34**: 1126-1129

Stirling, I., Calvert, W., Cleator, H. 1982. Underwater vocalizations as a tool for studying the distribution and relative abundance of wintering pinnipeds in the High Arctic. *Arctic*, **36**: 262-274.

Stirling, I. 1988. Attraction of polar bears *Ursus maritimus* to off-shore drilling sites in the eastern Beaufort Sea. *Polar Rec.* **24**: 1-8.

- 1924 Stirling, I., Andriashek, D. 1992. Terrestrial denning of polar bears in the eastern
1925 Beaufort Sea area. *Arctic*, **45**: 363-366.
- 1926
- 1927 Stirling, I., Derocher, A. E. 1993. Possible impacts of climatic warming on polar
1928 bears. *Arctic*, **46**: 240-245.
- 1929
- 1930 Stirling, I., Andriashek, D. A., Calvert, W. 1993. Habitat preferences of polar
1931 bears in the western Canadian Arctic in late winter and spring. *Polar Rec.* **29**:
1932 13-24.
- 1933
- 1934 Stirling, I., Lunn, N. J., Iacozza, J. 1999. Long-term trends in the population
1935 ecology of polar bears in western Hudson Bay in relation to climatic change.
1936 *Arctic*, **52**: 294-306.
- 1937
- 1938 Stirling, I., Parkinson, C. L. 2006. Possible effects of climate warming on selected
1939 populations of polar bears (*Ursus maritimus*) in the Canadian Arctic. *Arctic*, **59**:
1940 261-275.
- 1941
- 1942 Stroeve, J., Holland, M. M., Meier, W., Scambos, T., Serreze, M. 2007. Arctic sea
1943 ice decline: faster than forecast. *Geophys. Res. Lett.* **34**: L09501.
- 1944
- 1945 Taylor, M., Larsen, T., Schweinsburg, R. E. 1985. Observations of intraspecific
1946 aggression and cannibalism in polar bears (*Ursus maritimus*). *Arctic*, **38**: 303–
1947 309.
- 1948
- 1949 Taylor, M. K., Lee, L. J. 1995. Distribution and abundance of Canadian polar bear
1950 populations: a management perspective. *Arctic*, **48**: 147–154.
- 1951
- 1952 Taylor, M. K., Akeeagok, S., Andriashek, D., Barbour, W., Born, E. W., Calvert,
1953 W., Cluff, H. D., Ferguson, S., Laake, J., Rosing-Asvid, A., Stirling, I., Messier,
1954 F. 2001. Delineating Canadian and Greenland polar bear (*Ursus maritimus*)
1955 populations by cluster analysis of movements. *Can. J. Zool.* **79**: 690–709.
- 1956
- 1957 Taylor, M. K., Laake, J., Cluff, H. D., Ramsay, M. A., Messier, F. 2002. Managing
1958 the risk from hunting for the Viscount Melville Sound polar bear population.
1959 *Ursus*, **13**: 185–202.
- 1960
- 1961 Taylor, M.K., Laake, J. L., McLoughlin, P. D., Born, E. W., Cluff, H. D., Ferguson,
1962 S. F., Rosing-Asvid, A., Schweinsburg, R., Messier, F. 2005. Demography and
1963 viability of a hunted population of polar bears. *Arctic*, **58**: 203–214.

1964
1965 Taylor, M.K., Laake, J.L., McLoughlin, P.D., Cluff, H.D., Messier, F. 2006.
1966 Demographic parameters and harvest-explicit population viability analysis for
1967 polar bears in M'Clintock Channel, Nunavut. *J. Wildl. Manage.* **70**: 1667–1673.
1968
1969 Taylor, M.K., Laake, J. L., McLoughlin, P. D., Cluff, H. D., Born, E. W., Rosing-
1970 Asvid, A., Messier, F. 2008a. Population parameters and harvest risks for
1971 polar bears (*Ursus maritimus*) in Kane Basin, Nunavut and Greenland. *Polar*
1972 *Biol.* **31**: 491-499.
1973
1974 Taylor, M. K., P. D. McLoughlin, and F. Messier. 2008b. Sex-selective harvesting
1975 of polar bears *Ursus maritimus*. *Wildlife Biology* 14:52-60.
1976
1977 Taylor, M.K., Laake, J. L., McLoughlin, P. D., Cluff, H. D., Messier, F. 2009.
1978 Demography and population viability of polar bears in the Gulf of Boothia,
1979 Nunavut. *Mar. Mammal Sci.* **25**: 778-796.
1980
1981 Thiemann, G. W., Iverson, S., Stirling, I. 2008. Polar bear diets and Arctic marine
1982 food webs: insights from fatty acid analysis. *Ecol. Monogr.* **78**: 591-613.
1983
1984 Thenius, E. 1953. Concerning the analysis of the teeth of polar bears. *Mammal.*
1985 *Bull.* **1**: 14-20.
1986
1987 Tyrrell, M. 2006. More bears, less bears: Inuit and scientific perceptions of polar
1988 bear populations on the west coast of Hudson Bay. *Inuit Studies*, **30**: 191–208.
1989
1990 Van de Velde, F., Stirling, I., Richardson, E. 2003. Polar bear (*Ursus maritimus*)
1991 denning in the area of the Simpson Peninsula, Nunavut. *Arctic*, **56**: 191–197.
1992
1993 Verreault, J., Gabrielsen, G. W., Chu, S. G., Muir, D. C. G., Andersen, M.,
1994 Hamaed, A., Letcher, R. J. 2005a. Flame retardants and methoxylated and
1995 hydroxylated polybrominated diphenyl ethers in two Norwegian Arctic top
1996 predators: Glaucous gulls and polar bears. *Environ. Sci. & Technol.* **39**: 6021-
1997 6028.
1998
1999 Verreault, J., Muir, D. C. G., Norstrom, R. J., Stirling, I., Fisk, A. T., Gabrielsen,
2000 G. W., Derocher, A. E., Evans, T. J., Dietz, R., Sonne, C., Sandala, G. M.,
2001 Gebbink, W., Riget, F. F., Born, E. W., Taylor, M. K., Nagy, J., Letcher, R. J.
2002 2005b. Chlorinated hydrocarbon contaminants and metabolites in polar bears
2003 (*Ursus maritimus*) from Alaska, Canada, East Greenland, and Svalbard: 1996-

2002. *Sci. Total Environ.* **351**: 369-390.
- Verreault, J., Norstrom, R. J., Ramsay, M. A., Mulvihill, M., Letcher, R. J. 2006. Composition of chlorinated hydrocarbon contaminants among major adipose tissue depots of polar bears (*Ursus maritimus*) from the Canadian high Arctic. *Sci. Total Environ.* **370**: 580-587.
- Verreault, J., Dietz, R., Sonne, C., Gebbink, W. A., Shamiri, S., Letcher, R. J. 2008. Comparative toxokinetics of organohalogen contaminants in two top Greenland carnivores: Captive sledge dogs (*Canis familiaris*) and wild polar bear (*Ursus maritimus*). *Comp. Biochem. Physiol., Part C* **147**: 306–315.
- Vongraven, D., Peacock, E. 2011. Development of a pan-Arctic monitoring plan for polar bears: background paper. Circumpolar Biodiversity Monitoring Programme, CAFF Monitoring Series Report No.1, January 2011, CAFF International Secretariat, Akureyri, Iceland.
- Vongraven, D. et al. 2012. A circumpolar monitoring framework for polar bears. *Ursus Monogr. Ser.* 5.
- Wang, M., Overland, J. E. E. 2012. A sea ice free summer Arctic within 30 years- an update from CMIP5 models, *Geophys. Res. Lett.*, DOI:10.1029/2012GL052868.
- Watts, P. D., Hansen, S. E. 1987. Cyclic starvation as a reproductive strategy in the polar bear. *Symp. Zool. Soc. (Lond.)* **57**: 305-318.
- Wenzel, G. 1983. Inuit and polar bears: observations from a hunt near Resolute Bay, N.W.T. *Arctic* **38**: 90-94.
- Wenzel, G. 1995. Ningiqtuq: Inuit resource sharing and generalized reciprocity in Clyde River, Nunavut. *Arctic Anthropology* **32**: 43-60.
- Wenzel, G. 2004. Polar bear as a resource: an overview. Third northern research forum open meeting position paper. URL: http://www.nrf.is/open_meetings_files/Yellowknife_2004/Wenzel.pdf.
- Wiig, Ø., Amstrup, S., Atwood, T., Laidre, K., Lunn, N., Obbard, M., Regehr, E., and Thiemann, G. 2015. *Ursus maritimus*. The IUCN Red List of Threatened Species 2015: e.T22823A14871490.

2046 Wimsatt, W. A. 1963. Delayed implantation in the Ursidae, with particular
2047 reference to the black bear (*Ursus americanus* Pallas). Pp. 49-76 in Delayed
2048 implantation. A.C. Enders (ed.). University of Chicago Press, Chicago, IL.

Part 4 – Recovery Strategy for the Polar Bear (*Ursus maritimus*) in Manitoba

NOTE: The Recovery Strategy for the Polar Bear in Manitoba will be adopted as Part 4 of the Federal Management Plan once it is transmitted to Environment and Climate Change Canada.

Part 5A – *Polar Bear* – Ontario Government Response Statement, prepared by the Ontario Ministry of Natural Resources and Forestry (2016) (species-specific policy)

NOTE: The Government Response Statement for Polar Bear in Ontario was published in 2016 and contains references to commitments made in Ontario's Climate Change Strategy and Action Plan. Since the publication of this document, a revised provincial approach to addressing climate change has been proposed in the Made-in-Ontario Environment Plan.

Polar Bear

Ontario Government Response Statement



Protecting and Recovering Species at Risk in Ontario

Species at risk recovery is a key part of protecting Ontario's biodiversity. The *Endangered Species Act, 2007* (ESA) is the Government of Ontario's legislative commitment to protecting and recovering species at risk and their habitats.

Under the ESA, the Ministry of Natural Resources and Forestry (the Ministry) must ensure that a recovery strategy is prepared for each species that is listed as endangered or threatened. A recovery strategy provides science-based advice to government on what is required to achieve recovery of a species.

Within nine months after a recovery strategy is prepared, the ESA requires the Ministry to publish a statement summarizing the government's intended actions and priorities in response to the recovery strategy. The response statement is the government's policy response to the scientific advice provided in the recovery strategy. In addition to the strategy, the government response statement considered (where available) input from stakeholders, other jurisdictions, Indigenous communities and organizations, and members of the public. It reflects the best available local and scientific knowledge, including Traditional Ecological Knowledge, at this time and may be adapted if new information becomes available. In implementing the actions in the response statement, the ESA allows the Ministry to determine what is feasible, taking into account social and economic factors.

The Recovery Strategy for the Polar Bear (*Ursus maritimus*) in Ontario was completed on December 7, 2011. To comprehensively consider and address the complexities associated with the protection and recovery of Polar Bear, the Ministry took additional time to prepare this GRS. During this time,

The Polar Bear or *Wabusk* in Cree is the largest species of bear globally and is among the largest carnivores found on land. Males can weigh up to 800 kg with females generally weighing less than 400 kg. The Polar Bear has translucent hair that appears white, allowing it to blend in with its snowy surroundings.

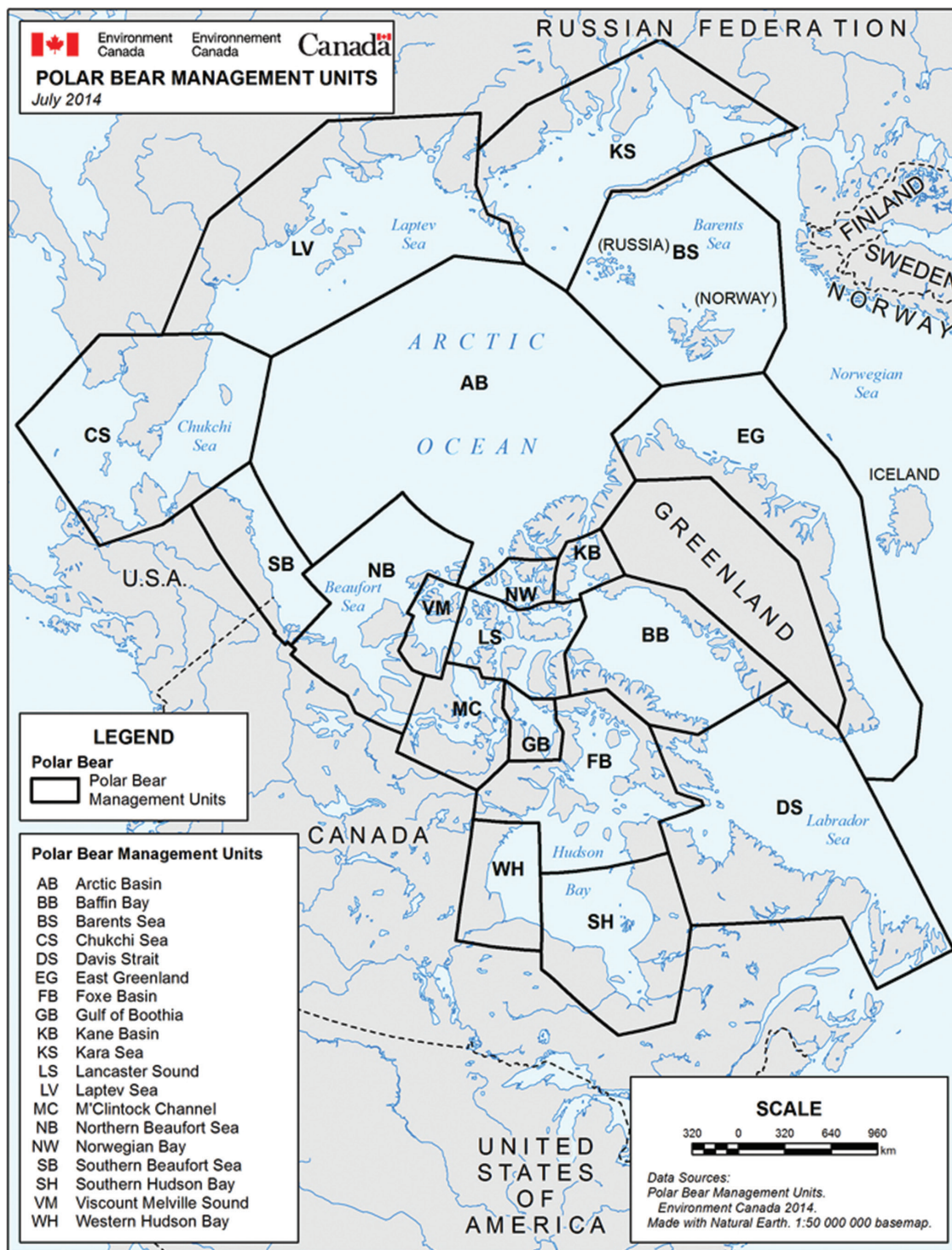
the Ministry held multiple engagement sessions with stakeholders, met with other levels of government including Indigenous communities, and facilitated discussions with interested First Nation communities. All recommendations provided in the recovery strategy, advice provided through consultation and engagement, and additional jurisdictional, scientific and economic information were considered in developing this government response statement. This GRS identifies actions that are considered to be appropriate and necessary for the protection and recovery of the species.

Protecting and Recovering Polar Bear

Polar Bear is listed as a threatened species under the ESA, which protects both the animal and its habitat. The ESA prohibits harm or harassment of the species and damage or destruction of its habitat without authorization. Such authorization would require that conditions established by the Ministry be met.

Polar Bears are found throughout the circumpolar Arctic region of the northern hemisphere. As a result, the protection and recovery of the species requires collaboration and management at both the national and international scale. Polar Bears can be found in parts of Canada, the U.S., Greenland, Russia, and Norway. Thirteen of the nineteen global subpopulations occur either fully or partially in Canada, with the Canadian population of Polar Bear currently estimated at 15,000 individuals. Ontario Polar Bears are the most southern breeding in the world and are estimated to be between 900 and 1000 individuals. In Ontario, their range extends along the Hudson and James Bay coasts, and the majority of the provincial population is made up of individuals from the Southern Hudson Bay subpopulation with a very small amount from the Western Hudson Bay subpopulation in the northwestern corner of the province.

Polar Bears depend on sea ice to carry out important life processes and are generally limited to marine environments where sea ice occurs most of the year. Polar Bears can be found on the sea ice from late fall until early summer carrying out critical life functions such as feeding and mating. Pregnant females often use permafrost features inland from the coast to den for the winter. Polar Bears in Ontario construct maternal dens in palsas (elevated permafrost features), treed areas and in the sides of peat banks and gravel ridges. Polar Bears depend primarily on Ringed Seals as well as Bearded and Harbour Seals as a food source, collectively comprising up to 95% of their diet. For four to five months during the ice-free season, the bears are forced onto land where they largely depend on the fat reserves that they accumulated throughout the winter.



Polar Bears are culturally and economically significant for the coastal Cree First Nations communities in Ontario. Section 35 of Canada's *Constitution Act, 1982* recognizes and affirms the existing Aboriginal and Treaty rights of Aboriginal peoples, who include the First Nation, Inuit and Métis peoples of Canada. Depending on the terms of a particular treaty and the historical evidence, these rights may include harvesting Polar Bear for food, social and ceremonial purposes. In Ontario, First Nation communities along the Hudson and James Bay coasts are members of Treaty 9, and have the right to harvest Polar Bears. Currently, harvest levels of Polar Bears in Ontario are voluntarily established through co-management agreements between the First Nation communities and provincial or territorial governments, and are considered sustainable. These levels require ongoing evaluation to ensure sustainability based on changes in threats and global population levels.

The greatest threat to Polar Bears is the alteration of their habitat due to climate change. Climate change is defined as any significant change in long-term weather patterns. Global warming describes the recent rise in the average global temperature. The rate of global warming over the last 50 years is almost double the rate of warming over the previous 100 years. Worldwide, 14 of the last 15 years have been the warmest on record. For Polar Bears, warmer temperatures are resulting in changes to terrestrial denning sites, including the collapse of permafrost features such as palsas, and decreased duration and distribution of sea ice which makes it increasingly difficult for the bears to efficiently catch seals. The species' reliance on terrestrial areas is expected to increase with earlier melting of sea ice in summer and later forming of sea ice in fall. This change will increase stress levels in the bears and result in decreased body condition from depletion of their fat reserves. This also makes them more susceptible to other threats such as increased human-bear interactions, changes in land and sea uses by humans, pollutants, and potential unsustainable harvest.

The Polar Bear's scientific name, *Ursus maritimus*, means "sea bear" as they are the only bear that depends upon the marine environment for survival.



Photo: iStockPhoto

Currently, the impacts of these threats are being observed in a significant reduction in the bears' body condition although at this time, population numbers in Ontario remain relatively stable. Nevertheless, climate change models predict that without significantly halting climate change, Polar Bears are likely to be extirpated from Ontario within 40 to 100 years. It is uncertain whether it will be possible in the long-term to retain a Polar Bear population in Ontario given that the Ontario population is at the southern extent of the species' global range and that it is the shared global responsibility of governments and citizens to effectively address the primary threat of climate change. The focus of protection and recovery activities for Polar Bear in Ontario will focus on addressing climate change, collaborating with Indigenous communities and organizations, continued cooperative work in science, research and monitoring, and Ontario's continued role working in collaboration with other jurisdictions for the global protection and recovery of Polar Bear.

Government's Recovery Goal

The government's goal for the recovery of the Polar Bear is to extend the length of time that the species persists in Ontario to the extent possible, and to collaborate with other jurisdictions, including Indigenous communities and organizations, to increase the likelihood of the species' persistence within Canada.

Actions

Protecting and recovering species at risk is a shared responsibility. No single agency or organization has the knowledge, authority or financial resources to protect and recover all of Ontario's species at risk. Successful recovery requires inter-governmental co-operation and the involvement of many individuals, organizations and communities. In developing the government response statement, the Ministry considered what actions are feasible for the government to lead directly and what actions are feasible for the government to support its conservation partners to undertake.

The government endorses the following actions as being necessary for the protection and recovery of Polar Bear. Support for the implementation of these actions may be provided through funding, agreements, permits (including conditions) and advisory services.

Actions identified as “high” will be given priority consideration for government funding under the ESA. The government will focus its support on these high-priority actions over the next five years. Annual priority actions for government support across all species will be established and communicated to encourage collaboration and reduce duplication of efforts.

Focus Area: Climate Change Mitigation and Habitat Management

Objective: Work collaboratively to maintain suitable habitat conditions for Polar Bear in Ontario, to the extent possible.

Effectively addressing the threat of climate change is a global priority and addressing this threat requires coordinated actions at provincial, national, and global scales, from governments, organizations and individuals. The Ontario government has demonstrated leadership through the development of the *Climate Change Strategy* released in 2015 supported by a Climate Change Action Plan, first released in spring 2016, and the development of a provincial cap and trade program. The Ontario government set out a series of actions in the first Climate Change Action Plan released in 2007 that helped the province achieve the ambitious goal of reducing Ontario’s greenhouse gas emissions by 6% below 1990 levels by 2014. Continued actions are underway to meet further greenhouse gas emissions targets set by the Ontario government: 15% below 1990 levels by 2020, 37% below by 2030, and 80% below by 2050. The Ontario government’s Climate Change Strategy identifies additional changes required to reduce greenhouse gas emissions and builds on the previous work completed in Ontario. Some examples of this include: developing a land use carbon inventory to allow Ontario to assess the potential of agriculture, forestry and other land uses, such as wetlands and grasslands, to emit, remove and store carbon; and developing a forest carbon policy framework to explore the role of managed Crown forests in storing carbon. Only through collective action can we help to reduce the impacts of climate change. Taking action to mitigate the impacts of climate change will help to retain the sea ice and permafrost features that Polar Bears depend on for their food source and dens.

Large portions of Polar Bear habitat in Ontario are protected within Polar Bear (Wabusk) Provincial Park. This 2.4 million hectare park along the Hudson Bay coast provides protection for approximately 70% of the Polar Bear summer retreat habitat and an estimated third of the denning sites currently used by the entire Southern Hudson Bay population. Denning sites that are not dependent on permafrost are more common inside the

park and these could potentially increase in importance with warming temperatures. Under the ESA, habitat is protected through either the general habitat definition or through species-specific regulated habitat. Under the general habitat definition of the ESA, habitat protection is provided to the areas the species depends on directly and indirectly to carry out its life processes. This includes areas that support life processes necessary for the species to survive and reproduce such as breeding, hibernation, feeding, resting, and migration. Section 10 of the ESA prohibits the damage or destruction of the habitat of species listed on the Species at Risk in Ontario (SARO) List as endangered or threatened; this prohibition applies equally to habitat protected through the general habitat definition and through regulated habitat. A species-specific habitat regulation is not being developed at this time given that climate change is the primary threat to Polar Bears, development pressures within the range of Polar Bear are currently minimal, and a great deal of the species' habitat occurs on provincially protected and First Nations' lands. Polar Bear habitat will continue to be protected under the ESA through the definition of general habitat.

The Ontario government is also committed to addressing the potential impacts on Polar Bear habitat from development activities through land use planning and supporting the development of best management practices. A Far North Land Use Strategy for Ontario is currently being finalized. The Strategy will assist in the preparation of land use plans and guide the integration of matters that are beyond the geographic scope of the individual plans. It will contain guidance for planning teams on how to account for the needs of species at risk when preparing a plan. Currently, there is limited development activity occurring within the Ontario range of Polar Bears. However, with increasing temperatures and economic pressures there may be a corresponding increase in natural resource development such as mining, wind farms, or hydroelectric power. Developing approaches to reduce the effects of natural resource developments could be important in maintaining suitable Polar Bear habitat. The Ontario government is committed to working jointly with First Nations to develop community based land use plans in the Far North of Ontario. Through community based land use planning, First Nations and Ontario work together to decide what areas in the Far North are open for development and what areas should be protected. Wildlife, including Polar Bear, as well as climate change and cumulative effects will be themes considered in the planning process.

Actions:

1. **(High)** Work with communities and all sectors to implement, monitor and report on progress towards Ontario's Climate Change Strategy and Climate Change Action Plan to reduce greenhouse gas emissions.
(government led)
2. Work jointly with First Nations communities in the Far North through community based land use planning to consider wildlife, including Polar Bear, and identify community and broad-scale interests that reflect the complex nature of the ecology, culture and economics of the Far North.
(government led and government supported)
3. Develop, implement, and update, as needed, best management practices to reduce the potential impacts of development activities, such as mineral exploration, on Polar Bears and their habitat. **(government supported)**
4. Protect the Polar Bear and its habitat through the ESA.
(government led)

Focus Area: Monitoring and Research

Objective: Monitor trends in Polar Bear populations and implement actions to manage the detected impacts.

Having sound science and information on Polar Bear populations is key to making evidence-based decisions on how best to manage the species. Scientific information, including Traditional Ecological Knowledge and community knowledge, informs our understanding of Polar Bear and collectively this information provides a more comprehensive picture of how the species is doing and how we can address threats to its persistence. Continuing and expanding monitoring and research efforts will help to provide an early warning of changes occurring that may trigger the need for additional management actions.

The Ministry of Natural Resources and Forestry has a long history of working with external partners to increase our knowledge of Ontario's Polar Bear population. This work has included conducting aerial surveys to estimate population abundance and more intensive sampling using live capture and radio-telemetry approaches. These studies provide important information on the population's movement patterns, health and body condition, habitat use, and demographic structure (e.g., age classes and sex distribution). In addition, coastal Cree First Nation communities and academic partners have conducted studies to document historic and current patterns of Polar Bear

movement and behaviour in Ontario that have contributed to our collective knowledge.

The Ontario government is committed to continuing to support efforts that increase our knowledge on Polar Bear through science, including Traditional Ecological Knowledge. This includes conducting an aerial survey of the population every five years to monitor trends in abundance, performing additional analysis on Polar Bear data particularly related to body condition, expanding intensive survey efforts to include bears in James Bay, and supporting the development of community based monitoring programs. The Ministry of Natural Resources and Forestry carried out these aerial surveys in 2016 to obtain up to date information on Polar Bears in Ontario. To allow for improved integration of different types of information in management decision-making it is important to establish comparable methodology, to collaborate on studies across jurisdictions, and to develop processes for improved information sharing. Recommendations provided in the research article “A Circumpolar Monitoring Framework for Polar Bears” by Vongraven et al (2012) will help to inform these monitoring efforts in Ontario.

Another important area of science that will help to inform future Polar Bear management actions is that of climate projection modelling. Through the Climate Change Strategy, the Ontario government committed to establishing a climate change modelling collaborative for climate data. Open access to standardized and wide-ranging climate information will help both public and private sectors make informed and evidence-based decisions. This initiative may also help to refine assessments on the probability of Polar Bear persistence in Ontario and inform future management decisions.

As Polar Bear health and body condition decline, the potential for negative human-bear interactions increases. A decline in body condition is associated with lack of nutrition in or abundance in the Polar Bear diet. This decline has been used as an indicator in the State of Ontario’s Biodiversity 2010 report and *State of Ontario’s Biodiversity 2015* report. As a result of decline in access to food, Polar Bears may travel further afield to locate food sources and may enter local communities in their search for food. Planning for how to reduce the frequency and impact of these human-bear interactions is an important component of Polar Bear protection and recovery. Community based plans will support the ability to effectively address human-bear interactions in a community-specific way.

Actions:

5. **(High)** Develop and collaboratively implement a Polar Bear science program that assesses and examines correlations between the following:

Primary Focus:

- population distribution, size, and trends
- reproductive and survival rates
- body condition and health, including levels of contaminants
- timing of freeze-up and thaw of sea ice

Secondary Focus:

- use of maternal denning and resting habitat
- changes in the Polar Bear diet
- potential impacts of research methods on individuals.

(government led and government supported)

6. **(High)** Support coastal Cree First Nation communities in the establishment and implementation of a community based Polar Bear monitoring program. This could include collecting information on:

- location, abundance, and body condition of encountered Polar Bears;
- human-caused mortality including the cause of death (e.g., harvest, defence, euthanization) and basic biological information of the impacted bear (e.g., sex, size, and condition); and,
- Traditional Ecological Knowledge on the species' distribution and habitat use. **(government supported)**

7. **(High)** Develop, implement and evaluate, as appropriate, community based plans to reduce the frequency and impact of human-bear interactions. This may include:

- reducing attractants and access of the bears to communities, hunt camps, landfills, and development sites;
- monitoring the proximity of polar bears to communities using remote sensing; and,
- increasing awareness of non-lethal methods to protect people and property through educational activities.

(government supported)

8. Collaborate with coastal Cree First Nation communities to share information on Polar Bear knowledge and management and seek opportunities for greater collaboration on management activities.

(government led)

9. Contribute to refinements of climate change projection modelling to inform assessments on the probability of Polar Bear persistence in Ontario and future decision-making. **(government supported)**

Focus Area: Inter-jurisdictional Management

Objective: Collaborate with other jurisdictions to increase the likelihood of the persistence of Polar Bears in Ontario and Canada.

Globally, 19 subpopulations of Polar Bears have been identified by the International Union for the Conservation of Nature (IUCN) Polar Bear Specialist Group, 13 of which occur within Canada. Ontario Polar Bears are primarily from the Southern Hudson Bay subpopulation although a small portion are from the Western Hudson Bay subpopulation in the northwestern corner of the province. Since Polar Bears can travel widely within the subpopulation areas and also between them, collaboration with other jurisdictions that share these subpopulations will be critical for their recovery. This includes the federal government, Manitoba, Nunavut, Québec, coastal Cree First Nation communities, Nunavik Marine Region Wildlife Board, Nunavut Wildlife Management Board, Nunavut Tunngavik Incorporated, and Makivik Corporation. Ontario does not have jurisdiction of the sea ice and seal populations that Polar Bears depend on for survival, highlighting the critical importance of working with neighbouring jurisdictions and the federal government.

Several committees have been created to support inter-jurisdictional collaboration on Polar Bear science and management. The Polar Bear Specialist Group of the IUCN was established in 1968 and includes representatives from all countries that have Polar Bears within their jurisdiction. This group meets every 3 to 5 years and plays a key role in the global coordination, synthesis, and distribution of scientific information to support informed management decision making. The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) is a legally binding, international conservation agreement between governments created in 1973 to ensure that international trade of wild animal specimens, including Polar Bears, and plants does not threaten the survival of species. Polar Bear is included in Appendix II of CITES which allows for commercial international trade under strictly regulated conditions. In Canada, Environment and Climate Change Canada is the lead agency responsible for implementing CITES and works together with the provincial and territorial governments to support this international agreement.

In 1969, the Polar Bear Administrative Committee (PBAC) was established to provide a national forum for collaboration on the management of Polar Bears across Canadian jurisdictions. This committee also ensures alignment with the International Agreement on the Conservation of Polar Bears and their Habitat, which was signed by all member countries in 1973. In addition, the Polar Bear Technical Committee was established in 1970 to provide technical advice to PBAC related to Polar bear research, harvest and population trends, and recommended management actions. Both PBAC and the Polar Bear Technical Committee now meet at least once every year and members of the committees communicate regularly and produce reports highlighting the status of Polar Bears within Canada, current threats, new research activities, and management decisions.

The National Polar Bear Conservation Strategy for Canada, produced by Environment and Climate Change Canada, provides an overarching framework for a coordinated national approach to management across Canadian jurisdictions. The actions within this government response statement demonstrate Ontario's commitment to the national objectives and align with the direction in the national strategy. The Ontario government remains committed to working through inter-jurisdictional committees to enable coordinated approaches to research and management across the range of Polar Bears. Coordinating efforts and sharing knowledge on the effects of climate change and the status of Polar Bear subpopulations is of paramount importance to effectively protecting and recovering Polar Bears in Ontario, and across the Canadian range.

The responsibility for sustainably managing harvest levels of the Southern Hudson Bay subpopulation of Polar Bears is shared between the governments of Ontario, Nunavut, and Québec and the associated Indigenous communities. In Ontario, a subsistence harvest of Polar Bears is only allowed by Treaty 9 members from communities along the Hudson and James Bay coasts. A voluntary quota of 30 bears per year was established in 1976 through an informal agreement between the Ontario government and the coastal Cree First Nation communities. Since the 1990s, each year an average of approximately eight bears have been harvested, although in recent years this number has decreased. Since Ontario's Polar Bears can potentially be harvested in Nunavut or Québec, it is in the collective best interest of all parties to cooperate in establishing annual allowable harvest levels for the entire Southern Hudson Bay population. In Ontario, Québec and Nunavut, the harvest of Polar Bears is managed through co-management agreements between the governments and Indigenous communities. In 2014, a voluntary, combined quota of three was established

for Ontario and Québec Cree communities for the 2014-2015 and 2015-2016 seasons. Several meetings have been held between governments and Cree and Inuit hunters from each jurisdiction to discuss current population levels, health and sustainable harvest levels. The Ontario government is committed to continuing to work collaboratively with other governments, including Cree and Inuit organizations, and wildlife management boards to ensure harvest levels remain sustainable in the long term.

Actions:

10. Participate on inter-jurisdictional committees to contribute to a national approach for collaboration and coordination of Polar Bear monitoring and management including the:
 - Polar Bear Administrative Committee; and,
 - Polar Bear Technical Committee. **(government led)**
11. Work collaboratively with other governments including Cree and Inuit communities and organizations and wildlife management boards to establish, manage, and monitor sustainable harvest levels for the Southern Hudson Bay Polar Bear population. **(government led)**

Implementing Actions

Financial support for the implementation of actions may be available through the Species at Risk Stewardship Program. Conservation partners are encouraged to discuss project proposals related to the actions in this response statement with the Ministry. The Ministry can also advise if any authorizations under the ESA or other legislation may be required to undertake the project.

Implementation of the actions may be subject to changing priorities across the multitude of species at risk, available resources and the capacity of partners to undertake recovery activities. Where appropriate, the implementation of actions for multiple species will be co-ordinated across government response statements.

Reviewing Progress

The ESA requires the Ministry to conduct a review of progress towards protecting and recovering a species not later than five years from the publication of this response statement. The review will help identify if adjustments are needed to achieve the protection and recovery of the Polar Bear.

Acknowledgement

We would like to thank all those who participated in the development of the Recovery Strategy for Polar Bear (*Ursus maritimus*) in Ontario for their dedication to protecting and recovering species at risk.

For additional information:

Visit the species at risk website at ontario.ca/speciesatrisk

Contact your MNRF district office

Contact the Natural Resources Information Centre

1-800-667-1940

TTY 1-866-686-6072

mnr.nric.mnr@ontario.ca

ontario.ca/mnrf

**Part 5B – *Recovery Strategy for Polar Bear (Ursus maritimus)*
in Ontario, prepared by M.B. Tonge and T.L. Pulfer (2011)
(technical advice)**



Polar Bear

(Ursus maritimus) in Ontario

Ontario Recovery Strategy Series

Recovery strategy prepared under the *Endangered Species Act, 2007*

Natural. Valued. Protected.

About the Ontario Recovery Strategy Series

This series presents the collection of recovery strategies that are prepared or adopted as advice to the Province of Ontario on the recommended approach to recover species at risk. The Province ensures the preparation of recovery strategies to meet its commitments to recover species at risk under the Endangered Species Act (ESA) and the Accord for the Protection of Species at Risk in Canada.

What is recovery?

Recovery of species at risk is the process by which the decline of an endangered, threatened, or extirpated species is arrested or reversed, and threats are removed or reduced to improve the likelihood of a species' persistence in the wild.

What is a recovery strategy?

Under the ESA, a recovery strategy provides the best available scientific knowledge on what is required to achieve recovery of a species. A recovery strategy outlines the habitat needs and the threats to the survival and recovery of the species. It also makes recommendations on the objectives for protection and recovery, the approaches to achieve those objectives, and the area that should be considered in the development of a habitat regulation. Sections 11 to 15 of the ESA outline the required content and timelines for developing recovery strategies published in this series.

Recovery strategies are required to be prepared for endangered and threatened species within one or two years respectively of the species being added to the Species at Risk in Ontario list. There is a transition period of five years (until June 30, 2013) to develop recovery strategies for those species listed as endangered or threatened in the schedules of the ESA. Recovery strategies are required to be prepared for extirpated species only if reintroduction is considered feasible.

What's next?

Nine months after the completion of a recovery strategy a government response statement will be published which summarizes the actions that the Government of Ontario intends to take in response to the strategy. The implementation of recovery strategies depends on the continued cooperation and actions of government agencies, individuals, communities, land users, and conservationists.

For more information

To learn more about species at risk recovery in Ontario, please visit the Ministry of Natural Resources Species at Risk webpage at: www.ontario.ca/speciesatrisk

RECOMMENDED CITATION

Tonge, M.B. and T.L. Pulfer. 2011. Recovery Strategy for Polar Bear (*Ursus maritimus*) in Ontario. Ontario Recovery Strategy Series. Prepared for the Ontario Ministry of Natural Resources, Peterborough, Ontario. vii + 54 pp.

Cover illustration: Martyn Obbard

© Queen's Printer for Ontario, 2011
ISBN 978-1-4435-6785-5 (PDF)

Content (excluding the cover illustration) may be used without permission, with appropriate credit to the source.

Cette publication hautement spécialisée Recovery strategies prepared under the Endangered Species Act, 2007, n'est disponible qu'en anglais en vertu du Règlement 411/97 qui en exempte l'application de la Loi sur les services en français. Pour obtenir de l'aide en français, veuillez communiquer avec Cathy Darevic au ministère des Richesses naturelles au 705-755-5580.

AUTHORS

Melissa B. Tonge – Wildlife Biologist

Tanya L. Pulfer – Conservation Biologist, Nature Conservancy of Canada

ACKNOWLEDGMENTS

This recovery strategy was formed as a collaborative between scientific researchers, social-science researchers, conservation organizations, aboriginal communities and federal and provincial governments. We thank all of those who acted as advisors in the development of this strategy (identified in table on page iii).

Thank you to the community members of Fort Severn First Nation who hosted the second Polar Bear recovery strategy workshop and shared their knowledge and perspectives. Thank you also to Tommy Miles who translated between English and Cree and to the Keewaytinook Okimakanak Research Institute (KORI), Brian Walmark and Gerry Garland, who provided the technology to remotely connect other participants.

Thank you also to those who reviewed drafts of the recovery strategy including Cheryl Chetkiewicz, Andrew Derocher, Allan Edelsparre, Chief Matthew Kakekaspan, Harvey Lemelin, Martha Dowsley, Tommy Miles, Edward Morris, Martyn Obbard, Justina Ray, Gregory Thiemann, Ed Morris, Chris Chenier, Geoff York, Rachel Vallender, Paul Johanson, Graham Bryan, Angela Darwin, Tania Morais, Liz Sauer, Christina Rohe, Ken Tuininga, Brian Hutchinson, Don Sutherland, Emma Taylor, Paul Sampson, Jenny Gleeson, Ken Abraham, Kevin Middel, Greg Lucking, Maria de Almeida, Chris Heydon, Patrick Hubert, Bree Walpole, Kate Lillicrap as well as other anonymous reviewers. Thanks also go out to Andrea Hebb of the Nature Conservancy of Canada for preparing Figure 3.

We would like to acknowledge Dan Kraus of the Nature Conservancy of Canada, Martyn Obbard and Bree Walpole of the Ontario Ministry of Natural Resources for their guidance and expertise along the way.

Recovery Strategy for Polar Bear in Ontario

Advisors

NAME	AFFILIATION and OFFICE
Chris Chenier	Cochrane District Area Biologist Ontario Ministry of Natural Resources
Cheryl Chetkiewicz, PhD	Associate Conservation Scientist Wildlife Conservation Society Canada
Andrew Derocher, PhD	Professor University of Alberta, Professor
Martha Dowsley, PhD	Assistant Professor Lakehead University
Paul Mattinas	Community Member Attawapiskat First Nation
Matthew Kakakespan	Chief Fort Severn First Nation
Dan Kraus, MSc	Ontario Region Conservation Science Manager Nature Conservancy of Canada
Raynald Harvey Lemelin, PhD	Associate Professor Lakehead University
Mike Hunter	Community Member Peawanuck First Nation
Nick Lunn, PhD	Research Scientist, Wildlife Research Division Environment Canada
Tommy Miles	Band Councilor Fort Severn First Nation Council
Edward Morris, MSc	Northeast Zone Ecologist, Ontario Parks Ontario Ministry of Natural Resources
Martyn Obbard, PhD	Research Scientist Ontario Ministry of Natural Resources
Justina Ray, PhD	Executive Director and Co-Chair COSEWIC Terrestrial Mammal Sub-committee Wildlife Conservation Society Canada
Gregory Thiemann, PhD	Assistant Professor York University
Brian Walmark	Research Director Keewatinook Okimakanak Research Institute (KORI)
Bree Walpole, MSc	Species at Risk Recovery Biologist Ontario Ministry of Natural Resources
Lyle Walton, MSc	Wildlife Population Specialist Ontario Ministry of Natural Resources
Geoffrey York, MSc	Senior Program Officer WWF Global Arctic Programme

DECLARATION

The recovery strategy for the Polar Bear has been developed in accordance with the requirements of the *Endangered Species Act*, 2007 (ESA). This recovery strategy has been prepared as advice to the Government of Ontario, other responsible jurisdictions and the many different constituencies that may be involved in recovering the species.

The recovery strategy does not necessarily represent the views of all of the individuals who provided advice or contributed to its preparation, or the official positions of the organizations with which the individuals are associated.

The goals, objectives and recovery approaches identified in the strategy are based on the best available knowledge and are subject to revision as new information becomes available. Implementation of this strategy is subject to appropriations, priorities and budgetary constraints of the participating jurisdictions and organizations.

Success in the recovery of this species depends on the commitment and cooperation of many different constituencies that will be involved in implementing the directions set out in this strategy.

RESPONSIBLE JURISDICTIONS

Ontario Ministry of Natural Resources
Environment Canada – Canadian Wildlife Service

EXECUTIVE SUMMARY

Polar Bears (*Ursus maritimus*) or *Wabusk* in Cree, are the largest terrestrial carnivores in the world and occur throughout the circumpolar Arctic of the northern hemisphere. The coastal areas of Hudson and James Bay in Ontario have approximately 900 individuals and these bears comprise the southernmost population of Polar Bears in the world. Polar Bears are listed as threatened on the Species at Risk in Ontario (SARO) List and as special concern under the federal *Species at Risk Act* (SARA).

The distribution of Polar Bears in Ontario is influenced primarily by two factors: the type and distribution of sea ice and the density and distribution of seals. While Polar Bears live on land during part of the year, they carry out several critical life functions such as feeding and mating on sea ice. Maternal denning sites, spring feeding areas and fall staging areas are the three most critical components of Polar Bear habitat. Spring feeding areas are on sea ice whereas denning sites and staging areas occur on land. Polar Bears are found in high densities along the Ontario coast of Hudson Bay and the western coast of James Bay north of Attiwapiskat during the ice free season, typically between mid-July and November. This area is critically important for staging and resting for males and non-pregnant females. For denning, Polar Bears in Ontario commonly use palsas, eskers, elevated beach ridges and peat banks within 120 kilometres inland of the coastline. Research indicates there is some fidelity to general denning areas, though not necessarily to individual dens.

The greatest threats to Ontario's Polar Bears are habitat alterations due to climate change and an increase in mortality resulting from human-bear interactions. Climate change will result in a loss of sea ice habitat and maternal denning habitat. These changes will have the greatest impact on the survival of cubs and older bears. A loss of habitat and food sources because of climate change will increase the number of human-bear encounters. These encounters can threaten the safety of both Polar Bears and humans. Although current harvest levels of Polar Bears appear to be sustainable, there is potential for the harvest to become unsustainable in the Southern Hudson Bay subpopulation.

The recovery goal for the Polar Bear in Ontario is to have a viable sub-population that can persist in a changing environment and supports traditional uses of Polar Bears by coastal Cree communities.

The recovery objectives are to:

- reduce the impact of global climate change within Ontario;
- identify, protect and adaptively co-manage Polar Bear habitat in Ontario;
- conduct research to fill knowledge gaps that will aid in the recovery and protection of Polar Bears and their habitat;
- maximize Cree and Ontario's participation in inter-jurisdictional Polar Bear management and research in the Hudson and James Bay eco-region;

Recovery Strategy for Polar Bear in Ontario

- develop and implement effective monitoring strategies for Polar Bear, including community based monitoring;
- minimize incidental mortalities of Polar Bears;
- enhance communication and information sharing with coastal Cree communities and stakeholder groups on Polar Bear biology and management; and
- explore viable, sustainable and complementary activities to existing traditional harvesting of Polar Bear.

It is recommended that the Ontario coastline from the Manitoba border to Ekwan Point in James Bay, and extending 5 kilometres inland, be prescribed as habitat in the habitat regulation for Polar Bears under the *Endangered Species Act, 2007*. The community of Fort Severn, including a 5 kilometre area around it, should be excluded from the area prescribed in the habitat regulation since this represents unsuitable habitat for Polar Bears due to human development (i.e., housing and community infrastructure, airport and landfill).

Beyond the coastline, active dens and features that are unoccupied but appear suitable for denning should also be prescribed as Polar Bear habitat. Palsas over 1.5 metres tall, eskers, elevated beach ridges and peat banks surrounding lakes within 120 kilometres of the coast should be prescribed as habitat. It is also recommended that 500 metres around active dens also be prescribed as Polar Bear habitat so as to minimize the potential for den abandonment. The area between the Winisk and Severn Rivers is of particular importance for denning due to the high density of suitable palsas in the area.

The habitat needs for Polar Bears are expected to shift with a changing climate. Their reliance on terrestrial areas is expected to increase with earlier melting of sea ice in summer and later forming of sea ice in fall. Key aspects of the terrestrial habitat that are expected to change are the melting and inability of palsas to form and an increase in the frequency and intensity of wildfires. Therefore, it is recommended that the use of habitat by Polar Bears be reviewed every fifteen years with scientific experts and coastal Cree communities.

Guidance from coastal Cree communities based on their unique knowledge, perspectives and practices will be important to Polar Bear protection and recovery activities. In implementing the recommendations of this recovery strategy, Ontario should be mindful of Aboriginal and treaty rights protected under section 35 of the *Constitution Act, 1982* and meet any obligations to consult with Aboriginal peoples where its actions may adversely affect an established or asserted Aboriginal or treaty right.

TABLE OF CONTENTS

RECOMMENDED CITATION.....	i
AUTHORS.....	ii
ACKNOWLEDGMENTS.....	ii
RESPONSIBLE JURISDICTIONS	iv
EXECUTIVE SUMMARY.....	v
1.0 BACKGROUND INFORMATION.....	1
1.1 Species Assessment and Classification.....	1
1.2 Species Description and Biology.....	1
1.3 Distribution, Abundance and Population Trends	4
1.4 Habitat Needs	10
1.5 Threats to Survival and Recovery	11
1.6 Knowledge Gaps.....	19
1.7 Recovery Actions Completed or Underway.....	20
2.0 RECOVERY	23
2.1 Recovery Goal	23
2.2 Protection and Recovery Objectives	23
2.3 Approaches to Recovery.....	24
2.4 Area for Consideration in Developing a Habitat Regulation	36
LIST OF FIGURES	
Figure 1. Global distribution of Polar Bear Sub-populations.....	7
Figure 2. Canadian distribution of Polar Bear Sub-populations.....	8
Figure 3. Current distribution of Polar Bears in Ontario.....	9
LIST OF TABLES	
Table 1. Threats to Polar Bear survival and recovery in Ontario	12
Table 2. Protection and recovery objectives.....	23
Table 3. Approaches to recover Polar Bear in Ontario	24
APPENDICES	
Appendix 1. IUCNb Ranking Categories for Threats	53
Appendix 2. Body Condition Chart produced by Polar Bears International and World Wildlife Fund	54

1.0 BACKGROUND INFORMATION

1.1 Species Assessment and Classification

COMMON NAME: Polar Bear

SCIENTIFIC NAME: *Ursus maritimus*

SARO List Classification: Threatened

SARO List History: Threatened (2009), Special Concern (2004)

COSEWIC Assessment History: Special Concern (2008, 2002, 1999, 1991), Not at Risk (1986)

SARA Schedule: Schedule 1, Special Concern (2011)

CONSERVATION STATUS RANKINGS:

GRANK: G3

NRANK: N3

SRANK: S3

The glossary provides definitions for the abbreviations above.

1.2 Species Description and Biology

Species Description

Polar Bears (*Ursus maritimus*) or *Wabusk* in Cree, are the largest terrestrial carnivores in the world and the largest species in the bear (Ursidae) family (Stirling 1988; Stirling 1992). There is marked sexual size dimorphism in Polar Bears, with males weighing up to 800 kg and reaching 2.6 m in total length¹ (DeMaster and Stirling 1981, Derocher et al. 2005) and females up to 400 kg and 2.5 m in length (Amstrup 2003).

Polar Bear fur lacks pigment, but appears white because their hairs reflect light (DeMaster and Stirling 1981). During summer months Polar Bear coats often appear yellow or off-white due to oxidation from the sun or staining (DeMaster and Stirling 1981). Polar Bears have black skin which may help to absorb heat from the sun (Stirling 1988). Polar Bears are further distinguished from other bear species by their more elongated body, long neck, small ears, narrow head and snout, and by the elevated cusps on their molariform teeth (Stirling 1988).

¹ standard total length measurements for mammals are nose tip to tail tip

Recovery Strategy for Polar Bear in Ontario

Species Biology

Polar Bears have been described as sea-ice obligates – depending on sea ice for feeding, breeding, and movement (Gleason and Rhode 2009). In more northern regions Polar Bears can forage year round on ice floes. In their southern range Polar Bears are forced on shore during an ice free season (usually mid-July until November). The Southern Hudson Bay sub-population² is considered the most southern population of Polar Bears in the world, and is required to seek summer refuge on the Ontario mainland on the southern shores of Hudson Bay, or islands in James Bay. They are strong swimmers (Stirling 1988, Ferguson et al. 2001, Amstrup 2003, Gleason and Rhode 2009, Regehr et al. 2010), but are rarely seen swimming far from land or ice [ranging from 4.9-75.3 km and 22-349 km respectively (Monnett and Gleason 2006)].

Polar Bears are the most carnivorous of all bear species (Stirling 1988). Their primary prey are Ringed and Bearded Seals (*Pusa hispida* and *Erignathus barbatus*, respectively) (Stirling 1974, Stirling and McEwan 1975, Smith 1980, Stirling and Øritsland 1995, Derocher et al. 2002, Thiemann et al. 2008, Cherry et al. 2011), although other marine prey have been documented (Russell 1975, Smith 1985, Calvert and Stirling 1990, Smith and Sjare 1990, Stirling and Øritsland 1995, Reynolds and Rommel 1999, Derocher et al. 2002, Dyck and Kebreab 2009). Thiemann et al. (2008) found that the diet of Southern Hudson Bay Polar Bears is primarily Ringed Seals (over 80%) followed by smaller proportions of Bearded and Harbour Seals (*Phoca vitulina*) (10–15%). The density of Ringed Seals has been shown to be positively correlated with Polar Bear density (Stirling and Øritsland 1995).

When on land, Polar Bears rely largely on fat reserves for energy. However, their diet is supplemented with terrestrial food sources including a variety of berries, American Beaver (*Castor canadensis*), Canada Goose (*Branta canadensis*) and Snow Goose (*Chen caerulescens*) (Russell 1975, Derocher et al. 1993, Kakekaspan et al. 2010, Lemelin et al. 2010). Although there are some exceptions, it appears that little terrestrial food is incorporated into Polar Bear tissues (Ramsay and Hobson 1991, Hobson and Stirling 1997, Hobson et al. 2009, Peacock et al 2010).

Although Polar Bears hunt throughout the year, techniques and rates of success vary depending on the season (COSEWIC 2008). They are most active during spring and early summer when seals, particularly juveniles, are most abundant on the sea ice. Ringed Seals construct birth lairs by excavating snowdrifts that develop over breathing holes. Pups are born from late March to early April (Smith 1987). Although the snow structures conceal Ringed Seals from other predators, Polar Bears detect lairs by smell and dig into them to capture seals and pups (Smith and Stirling 1975, 1978). During winter, when juvenile seals are less abundant, Polar Bears are less active, probably as a means of conserving energy (Ferguson et al. 2001). In summer and autumn when

² Note: There are 19 different Polar Bear populations world-wide (explained in full in section 1.3). In Ontario, most Polar Bears belong to the Southern Hudson Bay sub-population with a small percentage belonging to the Western Hudson Bay sub-population (Figure 1).

Recovery Strategy for Polar Bear in Ontario

Hudson Bay is ice free, Hudson Bay Polar Bears³ move onto the mainland and Akimiski Island (Nunavut), where seals are generally thought to be inaccessible. However, there are observations of Polar Bears successfully hunting seals from the Hudson Bay shores (George Kakakespan pers. obs). During ice-free periods when Polar Bears cannot access seals, they must largely rely on fat reserves for approximately four to five months until freeze up occurs. Pregnant females are food deprived for eight months while they remain on land in maternal dens where they nurse their young (Ramsay and Stirling 1986, Peacock et al. 2010). They remain in these dens until the cubs are large enough to travel onto sea ice in late February through late March (Ramsay and Stirling 1986, Peacock et al. 2010).

Polar Bears are long-lived and have a low rate of reproduction (Simmond and Isaac 2007). Mating occurs from late March to late May when females come into estrus (Reynolds and Rommel 1999). Implantation of the fertilized egg is delayed until late September to early October (Derocher et al. 1992) when pregnant females move to dens on land; the rest of the population (males, subadult and non-breeding females with offspring) remains active (COSEWIC 2008). Active gestation lasts about 60 days with cubs being born between late November and early January (Derocher et al. 1992, Obbard pers. comm. 2010). At birth, cubs weigh on average 0.6 kg and are covered in extremely fine hair with their eyes closed (COSEWIC 2008). Almost 70 percent of litters consist of two cubs, 25 to 30 percent are singletons, and small percentages are triplets (Ramsay and Stirling 1988). Cubs are nursed inside the den and remain with their mothers until they are two-and-a-half years of age (Amstrup 2003).

Female Polar Bears in Hudson Bay become sexually mature after four or five years and produce cubs at age five or six (Stirling et al. 1980, 1984, Furnell and Schweinsburg 1984, Ramsay and Stirling 1988). Upon reaching sexual maturity, females generally reproduce once every three years (Reynolds and Rommel 1999). Males are thought to become reproductively mature between the ages of 8 and 10 years (Ramsay and Stirling 1988, Derocher and Stirling 1998). Polar Bears can live up to 25 years; however there is evidence their ability to reproduce declines after age 20 (Ramsay and Stirling 1998).

Throughout most of the year, Polar Bears are solitary, except for females accompanied by cubs or yearlings. The large home ranges of individuals may overlap but they do not defend territories (Ferguson et al. 1999, Parks et al. 2006). The adult sex ratio is 1:1 in un-harvested populations (COSEWIC 2008) but most populations in Canada are skewed towards more females due to hunting pressures on males (Derocher et al. 1997). As females generally reproduce once every three years, only a third of the adult females are sexually receptive in each breeding season. This can result in intense competition between males for mates (Derocher et al. 2010). In Ontario, the Polar Bear is protected under the *Endangered Species Act, 2007* (ESA). Polar Bears are also protected under the *Ontario Fish and Wildlife Conservation Act, 1997*, and there is no hunting or trapping season. Under Treaty 9, First Nation people residing along the

³ Polar bears in Hudson Bay are assigned to three sub-populations, Foxe Basin (FB), Western Hudson Bay (WH), and Southern Hudson Bay (SH).

Recovery Strategy for Polar Bear in Ontario

Hudson Bay and James Bay coast are permitted to harvest Polar Bears, including females with cubs and bears in dens.

Other than humans, Polar Bears do not have predators. However, they can be cannibalistic, occasionally killing cubs, yearlings and adult females, although the extent and population impact of this behaviour has not been well quantified (Derocher and Wiig 1999, Dyck and Daley 2002, Amstrup et al. 2006).

To date, a variety of diseases and parasites have been recorded to affect Polar Bears. Polar Bears are especially susceptible to the parasitic roundworm *Trichinella*, which they contract by feeding on infected seals (Forbes 2000). *Trichinella* larvae are commonly found in muscle tissue but can be found in various other parts of their body. If enough larvae encyst in one area, such as the heart, the tissue becomes severely damaged and death may result (Forbes 2000). Other illnesses known to affect Polar Bears, although less common, include bacterial leptospirosis, rabies and morbillivirus (Taylor et al. 1991, Garner et al. 2000, Quakenbush et al. 2009). Contaminants in Arctic ecosystems (expanded upon in Section 1.5) can further compromise the health of Polar Bears and have been purported to make Polar Bears more susceptible to disease and parasites (Sonne 2010).

Studies on the impact of indirect effects of climate change on wildlife health suggest that the overall health of an individual animal is the result of complex interactions among immune status, body condition, pathogens and their pathogenicity, toxicant exposure, and the various environmental conditions that interact with these factors (Burek et al. 2008). See Section 1.5 for more details on threats to Polar Bear populations.

1.3 Distribution, Abundance and Population Trends

Polar Bears range throughout the circumpolar Arctic of the northern hemisphere. They are generally limited to marine environments where the sea is ice-covered most of the year (Amstrup 2003). The distribution of Polar Bears generally responds to changes in the type, quality and extent of sea ice cover (Amstrup 2003). The current global distribution is thought to correspond to the historic distribution (COSEWIC 2008) with the exception of some recently noted shifts in the Western Hudson Bay subpopulation (Townes et al. 2010). Shifts in population ranges have been linked to changes in sea ice cover – both timing of ice formation, ablation, type of ice and percent cover (Gleason and Rode 2009, Townes et al. 2010).

The International Union for Conservation of Nature/Special Survival Commission (IUCN/SSC) Polar Bear Specialist Group has identified 19 different sub-populations of Polar Bears in the Arctic, covering five countries: Canada, United States of America (Alaska), Russia, Norway (Svalbard) and Greenland (Figure 1). Boundaries of the Southern Hudson Bay subpopulation are based on observed movements of marked bears, tag returns from harvested animals, capture and recapture studies as well as radio and satellite telemetry studies (Kolenosky and Prevett 1983, Kolenosky et al.

Recovery Strategy for Polar Bear in Ontario

1991, Taylor and Lee 1995, Bethke 1996, Taylor et al. 2001). Genetic studies have documented gene flow between all sub-populations, even over thousands of kilometres (Paetkau et al. 1995, Paetkau et al. 1999, Cronin et al. 2006, Crompton et al. 2008), which is likely a result of large home range sizes, high mobility and variations in sea ice and seal distributions. However, recent analysis of the most southerly sub-populations in Hudson Bay and James Bay (Foxy Basin, Davis Strait, Western Hudson Bay and Southern Hudson Bay) has revealed greater genetic differences in the James Bay group than previously thought, suggesting some degree of site fidelity to on-ice breeding areas (Crompton et al. 2008).

The current overall global abundance estimate is 20,000 to 25,000 individuals (Obbard et al. 2010). The Canadian population is currently estimated at 15,000 (Lunn et al. 2002, COSEWIC 2008). Thirteen of the nineteen sub-populations occur either wholly or partially in Canada, ranging from the Ontario shores of James Bay north to Ellesmere Island, Nunavut, and from northern Yukon in the west to Labrador in the east (Figure 2) (COSEWIC 2008, OMNR 2008, York 2009).

Ontario Polar Bears are the most southern breeding in the world (Obbard et al. 2007, Regehr et al. 2007, OMNR 2008) and are primarily from the Southern Hudson Bay sub-population with a small portion of the Western Hudson Bay sub-population in the northwestern corner of the province. They occur over James Bay and Hudson Bay in winter and are found within the traditional territory of the Cree of Ontario and Quebec and the Inuit of the Belcher Islands during the summer (Figure 3) (COSEWIC 2008, OMNR 2008, IUCN 2010, Lemelin et al. 2010, Peacock et al. 2010). They are regularly seen in the areas of Fort Severn, Peawanuck and Attawapiskat and are only occasionally seen in southern James Bay near the communities of Kashechewan, Fort Albany, Moosonee and Moose Factory (COSEWIC 2008, OMNR 2008, IUCN 2010a, Lemelin et al. 2010, Peacock et al. 2010)

The Western Hudson Bay sub-population is estimated at 1,000 individuals with shared management responsibility with Manitoba and Nunavut. The Southern Hudson Bay sub-population is estimated at about 900 individuals (Obbard et al. 2007). Data suggest that gene flow occurs among the Foxe Basin, Davis Strait, Western Hudson Bay and Southern Hudson Bay sub-populations (Figure 2) (Crompton et al. 2008).

The Western Hudson Bay sub-population has experienced a decline of 22 percent from 1,194 individuals [95% Confidence Interval (CI) = 1,020 - 1,368] in 1987 to 935 individuals [CI = 794 - 1,076] in 2004 (Regehr et al. 2007). Population numbers for reproductive adults from the Western Hudson Bay sub-population are thought to be stable because they have better body conditions (measured as mass of fat and skeletal muscle relative to body size) than older and younger age classes, and thus are better able to sustain themselves in times of nutritional stress (Regehr et al. 2007).

Population estimates for the Southern Hudson Bay sub-population have remained relatively unchanged over the past 20 years. Theories on why the number of individuals are stable include: that harvest levels were at sustainable levels during the 1990s and

Recovery Strategy for Polar Bear in Ontario

2000s and changes in sea ice distribution and duration have not happened as rapidly in the range of the Southern Hudson Bay sub-population as it has for the Western Hudson Bay sub-population; and that Polar Bears are long-lived animals so changes due to declining resource availability may be detected at the individual level before they are detectable at the population level (see Regehr et al. 2007 for example). Combined, these theories may explain why no change in abundance has been detected between the 20 year sampling period (Obbard pers. comm.).

While there has been no observed population decline in the Southern Hudson Bay sub-population, a significant decrease in overall body condition has been documented in all age and sex classes [2000–2005: Body Condition Index (BCI) = $+0.03 \pm 0.03$, $n = 450$; 1984–86: BCI = $+0.84 \pm 0.04$, $n = 298$ (Obbard et al. 2006)]. Also, despite the sub-population remaining relatively unchanged, the survival rates for all age and sex classes has decreased [subadults and adult females were 94% (95% CI = 68%, 100%) in 1984–1985 to 89% (95% CI = 79%, 99%) in 2003–2005; subadults and adult males were 88% (95% CI = 77%, 100%) in 1984–1985; 81% (95% CI = 66%, 96%) in 2003–2005 (Obbard et al. 2007)⁴]. Due to this decrease in body condition, and the documented declines in survival, this sub-population is thought to be at an ecological “tipping point,” and is predicted to undergo a rapid decline in the near future (Obbard pers. comm. 2010).

The community of Fort Severn has reported an increase in Polar Bear sightings and encounters in recent years (Miles pers. comm. 2010). The Peawanuck First Nation has reported seeing fluctuating population numbers through the years (community meeting with Chris Chenier 2010). Observations of an increasing population are consistent with other jurisdictions such as Nunavut (Dowsley 2007). Theories for the reported increase include: an increasing population (Miles pers. comm. 2010); immigration from adjacent sub-populations; increased hunting ranges by coastal Cree community members [i.e., people covering more ground and in turn seeing more bears (Lemelin pers. comm. 2010)]; and habitat changes due to climate change [e.g., location of the first ice floes in the fall may have changed the distribution of where Polar Bears are observed (Dowsley 2007)].

⁴ Imprecision by overlap of the confidence intervals in this study could not conclude whether declines in survival were not a chance occurrence.

Recovery Strategy for Polar Bear in Ontario

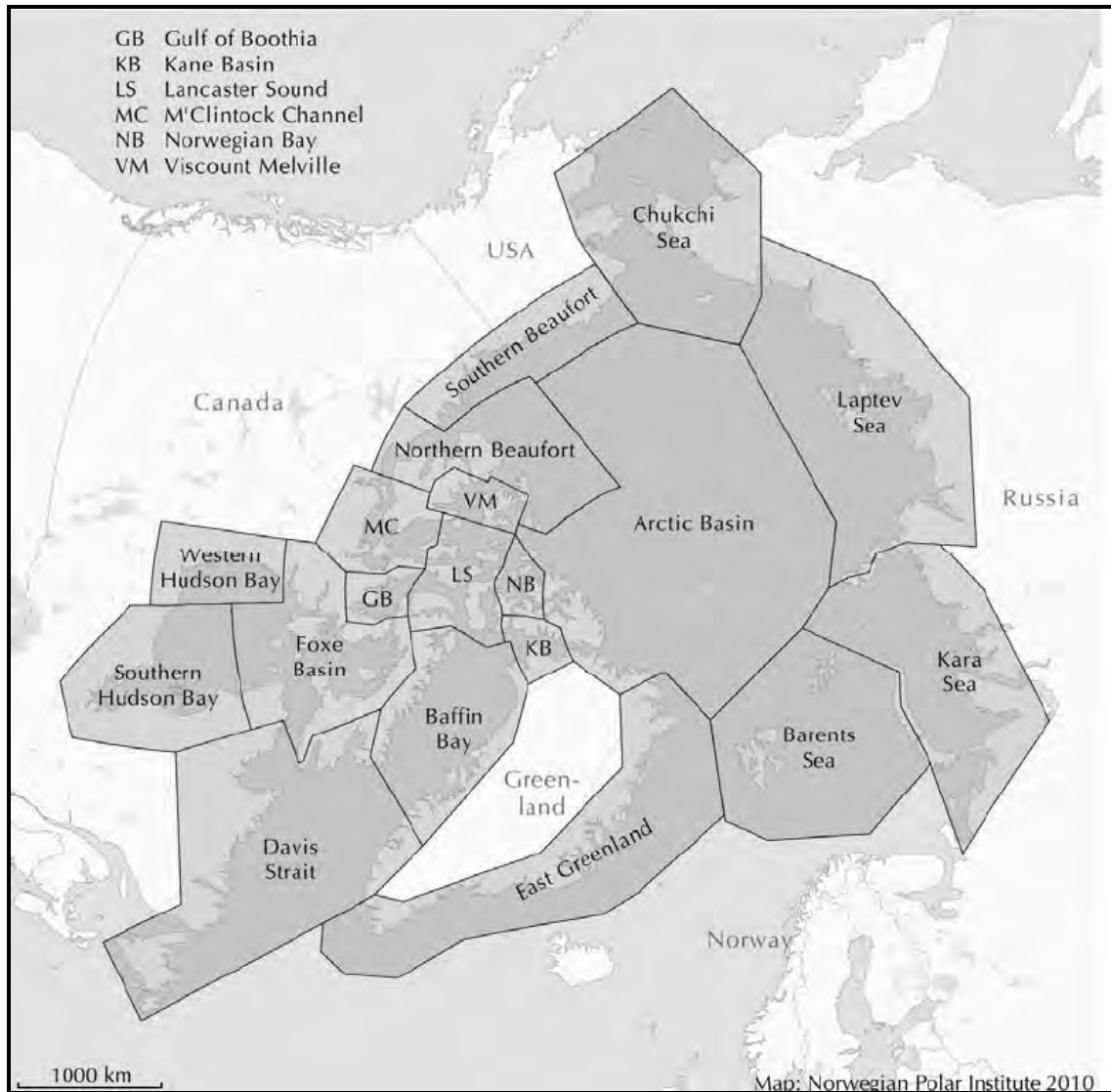


Figure 1. Global distribution of Polar Bear Sub-populations. Abbreviations include: Gulf of Boothia (GB), Kane Basin (KB), Lancaster Sound (LS), M'Clintock Channel (MC), Norwegian Bay (NB), Viscount Melville Sound (VM) (Obbard et al. 2010 [used with permission]).

Recovery Strategy for Polar Bear in Ontario

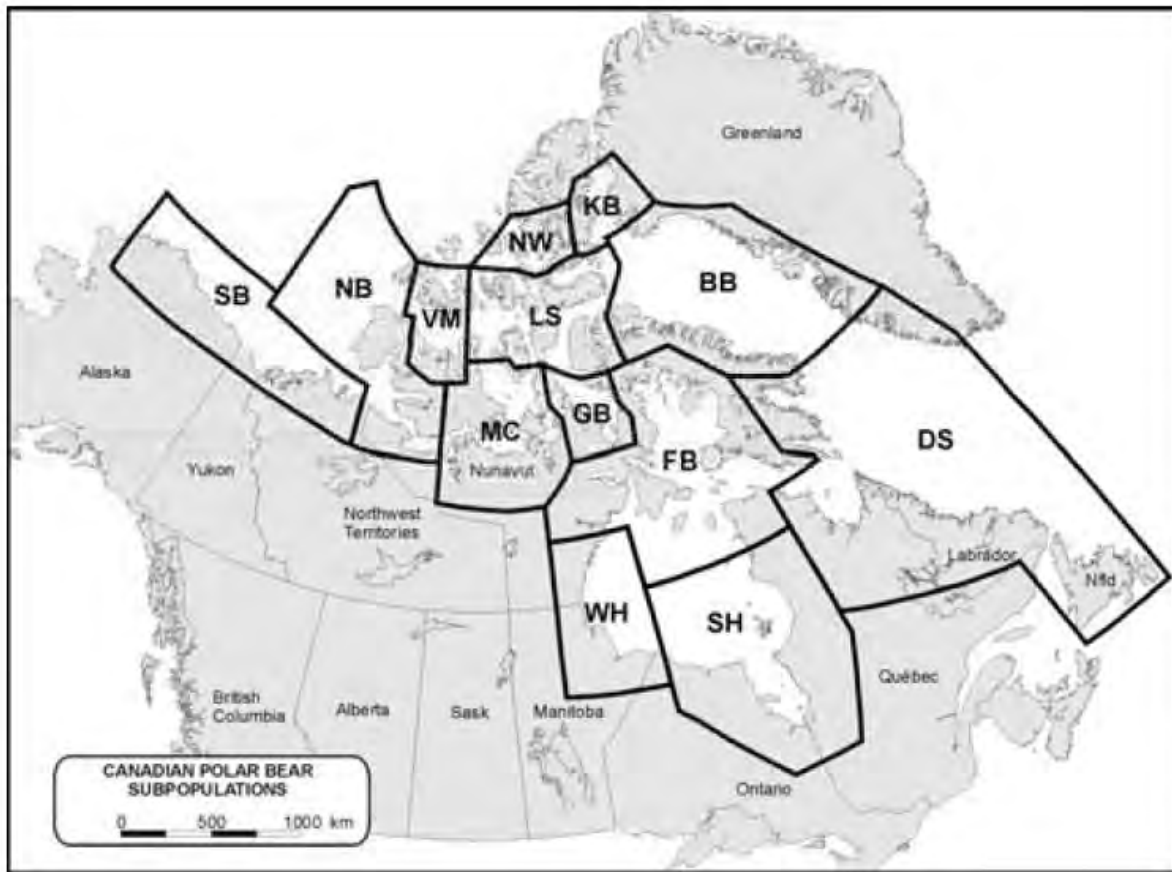


Figure 2. Canadian distribution of Polar Bear sub-populations. Abbreviations include: Baffin Bay (BB); Davis Strait (DS); Fove Basin (FB); Gulf of Boothia (GB); Kane Basin (KB); Lancaster Sound (LS); M'Clintock Channel (MC); Northern Beaufort Sea (NB); Norwegian Bay (NW); Southern Beaufort Sea (SB); Southern Hudson Bay (SH); Viscount Melville Sound (VM); Western Hudson Bay (WH) (Obbard et al. 2010 [used with permission]).

Recovery Strategy for Polar Bear in Ontario



Figure 3. Current distribution of Polar Bears in Ontario (adapted from OMNR 2008).

1.4 Habitat Needs

The distribution of Polar Bears in Ontario is primarily influenced by two factors: the type and distribution of sea ice and the density and distribution of seals (COSEWIC 2008). Polar Bears live on land during part of the year, but they carry out critical life functions such as feeding and mating on sea ice (Stirling and Smith 1975, Pomeroy 1997, Stirling 1997, Amstrup 2003). Polar Bears are found in the highest densities on sea ice, shore leads (the open area between the pack ice and shore) and polynyas (open areas of water surrounded by sea ice) where active sea ice and higher primary productivity attract prey (Amstrup 2003). There is evidence for a high degree of site fidelity to terrestrial areas used during the summer and some degree of site fidelity to on-ice mating areas (Derocher and Stirling 1990, Crompton et al. 2008, Towns et al. 2010).

Although home range size varies between individuals, Polar Bears in northern populations (Northern and Southern Beaufort Sea sub-populations) typically have larger home ranges (greater than 600,000 km²) (Derocher unpub. data) and spend almost all of their time on multi-year sea ice (Ferguson et al. 2000, Mauritzen et al. 2001, Towns et al. 2010). Polar Bears in the Southern Hudson Bay sub-population have considerably smaller home ranges (166,000 km²) that encompass land and sea ice (Parks et al. 2006). Smaller home ranges are most likely related to the unique aspect of Hudson Bay being ice-free for extended periods. The most southerly Polar Bears in James Bay have even smaller ranges of 45,000 km² (Obbard unpub. data 2010).

Females with cubs and subadults appear to avoid or at least minimize interactions with adult males, to decrease the chance of predation; as such they are typically associated with different habitat types (Amstrup et al. 2006). During the ice-free season males are frequently observed along coastal shorelines, whereas females and subadults are often found inland (Derocher and Stirling 1990, Lemelin et al. 2010, Towns et al. 2010). In Ontario, pregnant females typically den on land within 50 km of the coast (Kolenosky and Prevett 1983, Peacock et al. 2010) due to the availability of preferred natural denning features (listed below), but have been known to travel 120 km inland (OMNR 2008). One female was observed over 340 km inland (Obbard pers. comm. 2010). Coastal Cree harvesters have reported Polar Bears traveling up to 200 km inland into the muskeg during ice-free periods (Lemelin et al. 2010).

Maternal denning sites, spring feeding areas and staging areas are the three most critical components of Polar Bear habitat (Harington 1968, Stirling et al. 1984, Stirling 1990, Obbard and Walton 2004). Spring feeding areas are on sea ice whereas denning sites for Ontario sub-populations occur on land (Peacock et al. 2010). Aside from the regular use of dens by females with cubs, dens are occasionally used by solitary males and females during unfavourable weather (COSEWIC 2008). Southern Hudson Bay Polar Bears are found in high densities along the Ontario coast of southern coast of Hudson Bay and western coast of James Bay north of Attiwapiskat, during the ice-free season, typically between May and December. This area is important for staging and resting for males and non-pregnant females as they wait for freeze-up to occur.

In Ontario pregnant Polar Bears construct maternal dens in treed areas, peat banks along the edges of creeks, rivers and lakes adjacent to open lichen tundra sites, gravel ridges and palsas greater than 1.5 m in height (Kolenosky and Prevett 1983, Obbard and Walton 2004, OMNR 2008). Successful denning requires a sufficient amount of snow accumulation to ensure the den remains covered for the majority of the winter. In Hudson Bay, the denning time period is generally from November through to March (Richardson et al. 2005). Individual females demonstrate fidelity to general denning areas, though not necessarily to individual dens (Ramsay and Stirling 1990, Richardson et al. 2005).

1.5 Threats to Survival and Recovery

Threats to Polar Bears in Ontario were identified based on modified International Union for Conservation of Nature (IUCN 2010b) threat categories⁵ to ensure the full spectrum of potential threats were considered, and to facilitate comparisons with Polar Bear recovery planning documents from other jurisdictions. The identification and assessment of threats included both threats currently facing Polar Bears in Ontario and potential threats which could affect populations in the next 5 to 10 years and beyond.

Threats to Polar Bears rarely act in isolation. Polar Bears are exposed to threats linked to multiple human activities, land uses and climate change that directly or indirectly affect habitat and populations. Though many of the identified threats in this section do not pose a serious and immediate threat on their own, their combined or cumulative effects can have a more significant impact. Many of the threats to Polar Bears are also highly linked. For example, mineral exploration and consequently road development may directly reduce habitat available to Polar Bears, but it is also an underlying cause in increasing the threat of human-bear interactions which may result in more problem bears and more bear deaths.

Cumulative impacts can be difficult to quantify and predict, particularly when they are caused by a combination of land use, human activities and climate change. Overall, the greatest threats to Polar Bear are habitat alterations due to climate change and an increase in human-bear interactions (Table 1). Human-bear interactions are predicted to increase because of the impacts of climate change, such as a reduction in sea ice and consequently more time spent on land and increased development pressures.

⁵ International Union for Conservation of Nature IUCN categories were developed “to improve objectivity and transparency in assessing the conservation status of species, and ultimately to improve consistency and understanding among users” (IUCN Standards and Petitions Subcommittee 2010b).

Recovery Strategy for Polar Bear in Ontario

Table 1. Threats to Polar Bear survival and recovery in Ontario

Threat	Very High	High	Medium	Low
Habitat alterations due to Climate Change and Severe Weather				
• Reduction of mating and primary feeding habitat through loss of sea ice	X			
• Loss of permafrost, peat and maternal den sites in terrestrial habitats	X			
• Loss of prey species - Reduction and alteration of prey habitat	X			
• Alteration of land and sea-based habitat from temperature extremes	X			
• Higher energetic requirements from heat and extreme wind events		X		
• Increased fire events			X	
Bear-Human Interactions				
• Increased human-polar bear conflicts and damage to property		X		
Natural Resource Exploration and Production				
• Oil and gas exploration and production			X	
• Mining development and exploration			X	
• Wind turbines/Wind farm development				X
• Hydroelectrical development				X
Marine Transportation and Commercial Fishing				
• Shipping lanes within Polar Bear sea ice habitat			X	
• Incidental or accidental mortality from fishing and harvesting aquatic resources				X
Terrestrial Transportation and Service Corridors				
• Seasonal and permanent roads				X
Marine and Airborne Pollutants				
• Contaminants including Persistent Organic Pollutants (POPs), mercury and, hexachlorocyclohexanes (HCHs), perfluorochemicals (PFC), and Polychlorinated biphenyls (PCBs), etc.			X	
• Oil Spills			X	
Biological Resource Use				
• Potential for unsustainable harvest of Polar Bears ⁶			X	
• Poaching				X
Cumulative Effects of Threats				
• Cumulative effects of combinations of threats	X			

⁶ Note: Current harvest rates in Ontario are considered sustainable.

Climate Change and Severe Weather

Reduction of Mating and Primary Feeding Habitat through Loss of Sea Ice

Effects of climate change are considered the most significant threat to Canadian Polar Bear sub-populations (Stirling and Parkinson 2006, Durner et al. 2009, Hunter et al. 2010). Research suggests that by the mid-21st century, two-thirds of the world's Polar Bear sub-populations will be extirpated, mainly due to loss of sea ice as a direct result of climate warming (Amstrup et al. 2009). In Hudson Bay, later freeze-up dates and earlier thawing result in shorter periods of on ice activity. Climate change models estimate that the Southern Hudson Bay and Western Hudson Bay sub-populations will become extirpated within the next 45 years (Amstrup et al. 2007). Because Polar Bears depend on sea ice, changes in ice distribution and abundance can have significant impacts on individual and population conditions (Stirling and Derocher 1993, Derocher et al. 2004, Stirling 2006). A reduction in sea ice means fewer opportunities to efficiently catch seals. This results in increased fasting periods, and an increased need for and use of stored fat reserves. These factors may lead to a reduction in reproductive rates, reduced size and number of young and increased mortality in all age classes (Regehr et al. 2007, Schliebe et al. 2008, Hunter et al. 2010).

Other anticipated effects of reduced sea ice habitat include an expansion of summer habitat beyond the traditional range (recent observations have shown Polar Bears as much as 300 to 400 km inland) (Derocher et al. 2004), and larger home range sizes (Ferguson et al. 1999, Towns et al. 2010). There is some debate as to whether increased movement patterns of Polar Bears is an adaptive behaviour of climate change, resulting in bears exploring more inland areas for food. Declining body conditions and population size in the Western Hudson Bay sub-population has been correlated with earlier sea ice break-up (Stirling et al. 1999, Regehr et al. 2007). Similar body condition trends have been detected in the Southern Hudson Bay sub-population (Obbard et al. 2006). Longer movements over rougher sea ice and more open water could also increase risk of injury or death (Monnett and Gleason 2006), especially for cubs (Hunter et al. 2010).

Changes in climate also impact Polar Bear denning. As the distance between the edge of the sea ice and the shore increases, it becomes progressively more difficult for female Polar Bears to reach their preferred denning locations (Derocher et al. 2004, Bergen et al. 2007). Higher energy demands to reach denning sites can result in lower survival and reproduction rates (Derocher et al. 2004) by reducing fat reserves and thus affecting body condition (Stirling et al. 1999).

Loss of Permafrost, Peat and Maternal Denning Habitat

In Ontario palsas are an important component of Polar Bear denning habitat (Obbard and Walton 2004). Numerous studies have documented the vulnerability of palsas to climate fluctuations (Laberge and Payette 1995, Sollid and Soebel 1998, Zuidhoff and Kolstrup 2000) since they are a permafrost feature. In addition to providing den site stability, the presence of permafrost also provides a cool microenvironment for pregnant females, allowing them to conserve energy and avoid warm ambient temperatures and

Recovery Strategy for Polar Bear in Ontario

insects in the summer (Richardson et al. 2007). A change in climate and increased precipitation will result in geomorphological changes in permafrost and palsas, thus ultimately reducing the availability of these preferred maternal denning features.

Research also suggests that climate change will result in an increase in the frequency of forest fires caused by lightning strikes (Flannigan et al. 2000) and an extended fire season (Richardson et al. 2007). Fires affect maternal denning habitat by altering microhabitat features, such as removing vegetation in the area (namely trees), which aid in the stability and insulation of dens (Richardson et al. 2007). Fires also cause permafrost to melt, leading to palsa degradation, slumping of banks and decreased stability of sites resulting in a net-loss of maternal denning habitat. Black substrates that remain following fire absorb more solar radiation than vegetated areas, leading to a warmer microclimate that may prove unsuitable for Polar Bears (Richardson et al. 2007). In the Western Hudson Bay sub-population approximately five percent of existing suitable denning habitat was lost due to forest fires between 1998 and 2003 (Richardson et al. 2007).

Loss of Prey Species - Reduction and Alteration of Prey Habitat

Loss of sea ice will not only affect Polar Bears but will also impact the abundance and distribution of their main prey sources: Ringed Seals and Bearded Seals. Like Polar Bears, these two prey species are very sensitive to changes in sea ice cover and thickness (Tynan and DeMaster 1997, Derocher et al. 2004, Laidre et al. 2008). Observed impacts of warmer temperatures and increased precipitation include the collapse and decreased insulation of birth lairs as well as increased exposure of seal pups to predation (Stirling and Smith 2004). Polar Bears are most successful when hunting from the sea ice platform and are rarely successful in open water (Stirling and Smith 2004, York et al. 2009).

Higher Energetic Requirements from Extreme Wind Events

Climate change has contributed to the overall severity of storm impacts on coastal areas, resulting in high winds, storm surges, flooding and shoreline erosion (BESIS 1997, Cohen 1997, Griffin et al. 2010, Pryor and Barthelmie 2010). Resulting extreme winds are predicted to reduce ice thickness and increase ice drift. It is expected that increased ice movements will increase energetic requirements and could potentially reduce growth and reproductive rates in Polar Bears (Schliebe et al. 2008).

Polar Bear-Human Interactions

Increased Human/Polar Bear Conflicts

Human-bear interactions can result in disturbance, destruction or loss of property and/or the destruction of the Polar Bear or loss of human life. Time of year can greatly influence the number of human-bear interactions. Research conducted in Nunavut determined that the highest time for “defense of life or property” interactions (i.e., humans defending life or property, resulting in the kill of a bear) were between August and November (64%) while Polar Bears were waiting for sea ice to form (Dyck 2006). Due to fasting and limited feeding opportunities, Polar Bears may take greater risks for food during the fall than at other times of the year. Further to this, a recent study in the

Recovery Strategy for Polar Bear in Ontario

town of Churchill observed an increase in the number of problem⁷ Polar Bears with later sea ice freeze-up (Towns et al. 2009). Generally, subadult males (less than six years of age) are more curious and less cautious than other age-gender classes. While Polar Bears of any age class may be involved in human-bear interactions (Dyck 2006), subadult males are most often involved in these occurrences (Towns et al. 2010). An increase in the number of human-bear interactions will most likely result in higher numbers of problem bears being killed.

Northern communities in Ontario have reported a similar increase in encounters with problem Polar Bears in recent years (Lemelin et al. 2010). Some coastal Cree communities in the Hudson Bay area have reported increasingly aggressive and habituated Polar Bears in their communities (McDonald et al. 1997, Dyck 2006, Lemelin et al. 2010). Increased time on land and increased human-bear interactions will likely result in an increased number of defences of property and kills of Polar Bears if proper deterrent programs⁸ are not adopted (Stirling and Derocher 1993, Derocher et al. 2004, Peacock et al. 2010).

Natural Resource Exploration and Production

Oil and Gas Exploration and Production/ Mining Development and Exploration

In the Arctic, natural resource exploration and activity has expanded rapidly during the last 40 years (UNEP 2001), ultimately posing risks to Polar Bears and their terrestrial habitats (Øritsland et al. 1981, Hurst and Øritsland 1982, Griffiths et al. 1987). Exploration, transportation and processing for gas, oil and minerals can result in fragmented habitats (Fiori and Zalba 2003) and an increased level of pollutants in the environment (Olsgard and Gray 1995). Furthermore, there is potential for displacement of Polar Bears from resting and terrestrial feeding areas as well as a disruption to maternal den sites, resulting in premature abandonment of dens and/or offspring (Linnell et al. 2000). Climate change could also provide greater industrial access to resources, resulting in an increase in the frequency of human-bear interactions and conflicts (Dyck 2006).

Wind Turbine/Wind Farm Development

The shores of Hudson and James Bay in northern Ontario have excellent potential for wind power. Considerable winds blow over approximately 1,500 islands on the eastern side of Hudson Bay as well as along the western coast of Quebec along Hudson Bay and James Bay. The potential development of wind farms in Ontario would require high-powered, long distance transmission lines and thus would fragment Polar Bear habitat, particularly during ice-free periods when Polar Bears are forced on land. Another

⁷ Problem Polar Bear would be one that poses an immediate threat to human safety or one that has developed a pattern of behaviour that makes it a long term risk to safety or property. Not all human-bear interactions result in problem bears.

⁸ In Ontario it is legal for anyone to attempt to deter, and if necessary destroy, a Polar Bear in defense of life or property. Any bear killed must be reported to the nearest district Ministry of Natural Resources office. Possible deterrent methods include, but are not limited to: warning shots, cracker shells, screamers/bangers, flare guns, plastic slugs, rubber bullets, electric fences, bear spray, vehicles, air horns, dogs and bear monitors.

Recovery Strategy for Polar Bear in Ontario

potential concern would be the impacts of functioning turbines and disrupting maternal den sites, resulting in den abandonment.

Hydroelectrical Development

Many rivers flowing from Hudson Bay are being harnessed (or explored) for hydroelectrical development to meet southern Ontario energy demands (CARC 2002). Hydroelectric development in the Moose River basin on the Ontario side of James Bay started in 1910 (CARC 2002). In the Moose River Basin, the Abitibi and Mattagami Rivers have been the main river systems to be developed (Stokes et al. 1999), supplying power to mining and pulp and paper communities (Brousseau and Goodchild 1989, Poehlmann and Associates 1997). Current and proposed projects currently extend below ranges of Southern Hudson Bay Polar Bears, however with increasing energy demands from the south, hydroelectric development along other tributaries of James and Hudson Bays may increase. With these developments, an increase in the frequency of human-bear interactions and conflicts may arise.

Biological Resource Use

Potential for Unsustainable Harvest

In 1976, the Ontario government established harvest quotas of 30 bears per year through an informal agreement with Fort Severn, Peawanuck, Attawapiskat, Fort Albany and Kashechewan. Since then, research and monitoring has revealed that bears from the Southern Hudson Bay subpopulation are also harvested in Nunavut and Quebec. Kolenosky et al. (1992) calculated a maximum sustainable yield of 48 Polar Bears annually for this subpopulation by Aboriginal hunters in Nunavut, Quebec as well as Ontario. However, there is some concern that these harvest levels would likely be too high for the long-term sustainability of this sub-population (OMNR 2008). Annual minimum harvest levels in Ontario generally range between 8 and 13 Polar Bears (Lemelin et al. 2008, Kakekaspan et al. 2010). In 2011, larger than usual harvest (45 - 60 bears) from the Southern Hudson Bay sub-population by Northern Quebec hunters was reported (CBC 2011). Thus, the potential for unsustainable harvest in this sub-population is a valid concern over the long term.

The reporting of the harvest is voluntary in Ontario but is considered to be generally reliable because Polar Bear skins cannot be sold until they have been authorized and 'sealed' by the province. Quotas for each community that harvests Polar Bears have been enforced by the denial of the provincial seals that ensure the legal sale of hides. The Hunters and Trappers Association of Sanikiluaq has an annual quota of 25 Polar Bears through a Memorandum of Understanding with the Nunavut Department of Environment. Because Polar Bears in the Southern Hudson Bay sub-population mix with Polar Bears in other sub-populations (Stirling et al. 2004) it is difficult to determine what proportion of the Southern Hudson Bay sub-population is actually harvested, especially in Quebec (OMNR 2008).

Recovery Strategy for Polar Bear in Ontario

Continued sustainable harvest of Polar Bears by First Nations is important to ensure that the devaluation⁹, or a reduction in traditional uses of the species does not occur. Harvested Polar Bears in Ontario are used for crafts, subsistence purposes, traditional and ceremonial purposes (Lemelin et al. 2010, George Hunter pers. comm. 2010). The meat is eaten (by sled dogs and sometimes humans) and the hide is used to make mittens, mukluks, fur ruffs for parkas and fur pants, as well as small crafts that are used locally or sold (Kakekaspan et al. 2010). Polar Bear bones are a preferred tool to scrape caribou hides in some communities (George Hunter pers. comm. 2010).

Note regarding sustainable Aboriginal harvests in Ontario

Current harvest levels by members of Treaty 9 in Ontario are permitted and considered sustainable based on population estimates (Lunn et al. 2006). Province-wide, under a long-standing agreement with the coastal Cree communities, up to 30 hides can be sealed for sale annually [12 to Fort Severn, 12 to Winisk (Peawanuck), 6 shared between Attawapiskat, Fort Albany and Kashechewan] (OMNR 1980, OMNR 2008). During the 1970s and 1980s annual Ontario harvests averaged 20.7 individuals (Kolenosky et al. 1992). In recent years, Ontario's harvest has been considerably lower, averaging 8.8 Polar Bears annually of skins sealed and sold (Obbard 2007).

Marine Transportation and Commercial Fishing

Shipping Lanes within Polar Bear Sea Ice Habitat

Climate change and environmental change will likely increase the duration of shipping and fishing seasons and open up previously un-navigable routes in the Arctic. Disturbance associated with increasing levels of shipping activity, including commercial fishing¹⁰, community re-supply, industrial shipping and tourism would present increasing threats to Polar Bears. Consequences are likely to include directing Polar Bears into ports and coastal communities, fragmenting sea ice (by keeping lanes open with ice-breakers), disturbing prey, potential fuel oil spills and introduction of pollution and possibly exotics in ballast water. Impacts will vary depending on season, type and speed of vessel and time of day (Ward et al. 2005).

Terrestrial Transportation and Service Corridors

Seasonal and Permanent Roads

Roads and railways are generally known to interrupt habitat connectivity and to affect the hydrological regimes of terrestrial ecosystems (McPherson et al 2005). In addition to habitat fragmentation, roads can create easier access to Polar Bear habitat for humans.

Currently there is one seasonal road, which connects the communities of Peawanuck and Fort Severn. This road is a winter road and therefore requires annual construction and maintenance. The road intersects an area considered to be prime Polar Bear denning habitat. Direct impacts of this road include habitat fragmentation, increased

⁹ The devaluation of a species is considered a reduction in the value in commercial and cultural significance.

¹⁰ Commercial fishing is minimal in James Bay at this time and there is a low likelihood of it increasing considerably in the next 5 to 10 years.

Recovery Strategy for Polar Bear in Ontario

access to previously inaccessible habitat and potential disturbance to maternal dens. Increased mineral, oil and gas exploration and extraction is expected to increase road and railway networks in the Hudson Bay Lowlands to allow for improved access, and therefore may become a higher threat in the future.

Marine and Airborne Pollutants

Contaminants

As top predators, Polar Bears are exposed to high levels of pollutants through the food chain via biomagnification and bioaccumulation. Main toxins in the Arctic are persistent organic pollutants (POPs) and hexachlorocyclohexanes (HCHs). Persistent organic pollutants include a wide range of poisonous substances such as heat resistant chemicals (e.g., PCBs), flame retardants, industrial by-products such as dioxins and furans and pesticides like DDT, dieldrin and lindane (York et al. 2009). Mercury levels have also been noted to be increasing in Arctic waters (Lu et al. 2001), and Hudson Bay in particular (Kirk and St. Louis 2009).

Known effects of these toxins include organ failure, brain damage to young bears and disrupted sperm production (Sonne 2010). Pollutants such as POPs tend to persist in the environment and resist degradation (Lipnick 2000). High levels of POPs have been documented in seal blubber (Kucklick et al. 2006). Due to bioaccumulation, Polar Bears are particularly susceptible to the effects of POPs (Kucklick et al. 2002, CARC 2010).

Many of the high pollutant levels in Polar Bears appear to be from long range atmospheric transport from low latitude sources outside of the Arctic environment. These long range pollutants are negatively affecting Polar Bear growth patterns, reproduction (through delayed implantation which may lead to vulnerability through hormone disruption) and survival rates (decreased in lifespan, as well as cub sizes) (Skaare et al. 2002, Derocher et al. 2003, Schliebe et al. 2008). Polychlorinated biphenyls (PCBs) in particular are thought to be degrading Polar Bear immunity by disrupting a group of proteins that function as antibodies. The effects of long range transport may be enhanced as a result of climate change (CARC 2010) due to the melting of snow and ice caps (Barrie et al. 1985).

Oil and Gas Spills

Direct contact with oil and gas spills can reduce the insulating effect of Polar Bear fur (Hurst and Øritsland 1982, Hurst et al. 1991), resulting in higher energetic demands to keep warm thus forcing individuals to compensate for energy loss by increasing caloric intake (Hurst et al. 1991). Oil on the fur can also lead to decreased body temperature and be absorbed through the skin to the gastrointestinal tract (Engelhardt 1983). Given that Polar Bears in Ontario fast for extended periods of time, an increased demand for food, particularly if prey items have also been affected, may result in starvation and kidney failure due to bears ingesting oil while self grooming.

1.6 Knowledge Gaps

The following areas have been identified as knowledge gaps.

Natural Life History Information

- Distribution and abundance information on prey populations, mainly Ringed Seal and Bearded Seal.
- Annual variation in foraging (terrestrial and marine) by individual Polar Bears based on quantitative fatty acid signature analysis.
- Adjustments to annual foraging patterns (5-10 year comparisons) due to potential increased time spent on land.
- Examination of paleoecological data to provide a historical background to the environmental changes that Polar Bears have endured to date.

Distribution and Population Trends

- Distribution and movement of Polar Bears of the Southern Hudson Bay sub-population through satellite-telemetry.
- Population size and trend information including vital rates (survival, reproduction) through capture recapture techniques (approximately every 15 years) and standardized monitoring programs in coastal Cree Communities, to understand how vital rates will vary in the future with climate change¹¹.

Habitat Needs

- Response of Polar Bear habitat (e.g., denning and staging areas) to various forms of anthropogenic disturbance to inform best practices for development and exploration activities.
- Description of important Polar Bear habitat at fine spatial scales including denning and breeding areas using such data as Digital Elevation Models (DEM), airplane and helicopter surveys and satellite-telemetry coordinates.
- Significance of protected areas (e.g., Polar Bear Provincial Park) to the conservation of Polar Bears.

Climate Change Data

- Climate change data from northern Ontario that can be used to monitor changes in pack ice patterns and its relationship to Polar Bears and prey habitats.

First Nation Knowledge, Perspectives and Practices

- Cultural, spiritual, ecological and socio-economic significance of Polar Bears to coastal Cree communities.
- Traditional ecological and local knowledge of Polar Bear populations, management and harvesting practices.

Research Impacts

- Impacts from handling and other research effects on Polar Bears.

¹¹ These gaps will be difficult to address due to substrate wetness and dense tree cover which, in the past, have limited field work opportunities.

Human-Bear Interactions

- Quantified data on human-bear conflicts to compliment qualitative information, including cause of interaction (e.g., presence of attractant, proximity to human dwelling or structure, proximity to denning site) and harvest, if applicable.
- Relationship between sea ice reduction/decreased body condition and human-bear interactions.
- Socio-economic role of Polar Bears to coastal Cree communities (e.g., crafts from hides).
- Impacts of the Polar Bear tourism industry and domestic traffic [e.g., effects of all-terrain vehicle (ATV) and snow machine activity] on Polar Bear behaviour.

Emergency Response Plan

- Scenario-based emergency response plans, similar to marine mammal stranding network guidelines (e.g., Geraci and Lounsbury 2005). To be put in place if and/or when emergency scenarios come to fruition. Scenarios requiring emergency response may include massive die-offs due to drastic loss of habitat, prey availability, etc (see Peacock et al. 2011).

1.7 Recovery Actions Completed or Underway

- Identifying annual variation in foraging by individuals and between years based on quantitative fatty acid signature analysis.
 - Underway: collaboration between researchers at the Ontario Ministry of Natural Resources (OMNR) and York University 2007-2011 (Obbard pers. comm. 2010).
 - Cherry et al. (2011)
- Determining and describing important Polar Bear habitat, including denning and breeding areas, through airplane and helicopter surveys and radio-telemetry techniques.
 - Kolenosky and Prevett (1983).
 - Obbard and Walton (2004).
 - Underway: additional analysis of recent data from GPS-collared Polar Bears 2007-2011 (Obbard pers. comm. 2010).
- The significance of protected areas (e.g., Polar Bear Provincial Park) to the conservation of Polar Bears through radio telemetry techniques.
 - Obbard and Walton (2004).
 - Underway: additional analysis of recent data from GPS-collared Polar Bears 2007-2011 (Obbard pers. comm. 2010).
- Coastal Cree knowledge, perspectives and practices.
 - Lemelin et al. (2010).
 - Kakakespan et al. (2010).

Recovery Strategy for Polar Bear in Ontario

- Interviews/community focus groups (Martha Dowsley, R. Harvey Lemelin and Dave Finch pers. comm. 2010).
- Estimating and monitoring Polar Bear numbers through capture-recapture techniques.
 - Obbard et al. (2007).
- Defining the distribution and movement of Polar Bears of the Southern Hudson Bay sub-population through radio-telemetry and genetic techniques.
 - Crompton (2008).
 - Underway: research on movement patterns of GPS-collared Polar Bears 2007-2011 (Obbard pers. comm. 2010).
- Communication materials produced such as:
 - OMNR Climate Change Research Information Note No. 3 (Obbard et al. 2006) (Collaboration with OMNR and partners).
 - State of the Resources Reports: Polar Bears. Status of Southern Hudson Bay sub-population (Obbard et al. 2007) [collaboration with OMNR, the United States Geological Survey (USGS) and other partners].
 - State of the Resources Reporting (2008) in both English and Cree (OMNR).
 - Ontario Biodiversity Strategy Status Report 2005-2010 (collaboration with OMNR and partners).
 - Our Incredible World internet newsletter (www.incredibleworld.ca) (Funded by multiple partners including OMNR and Environment Canada).
 - Webcasts by Polar Bears International about Polar Bear research (www.polarbearsinternational.org/research/scientists).
 - Expert Panel on Climate Change Adaptation report “Adapting to Climate Change in Ontario” (Pearson and Burton 2009) (collaboration with Ontario Ministry of the Environment and partners).
 - Far North Science Advisory Panel Report “Science for a Changing Far North” (The Far North Science Advisory Panel, 2010) (collaboration with OMNR and partners).
 - Ontario’s Climate Change Adaptation Strategy (www.ene.gov.on.ca/stdprodconsume/groups/lr/@ene/@resources/documents/resource/stdprod_085423.pdf)
- Participation in inter-jurisdictional meetings such as:
 - IUCN/SSC Polar Bear Specialist Group.
 - Canadian Federal/Provincial/Territorial Polar Bear Technical Committee.
 - Canadian Federal/Provincial/Territorial Polar Bear Administrative Committee.
 - 2011 Meeting with Quebec, Nunavut, Ontario and Cree First Nations
- Climate change initiatives such as:
 - Ontario Green Energy Act 2009.

Recovery Strategy for Polar Bear in Ontario

- Expert Panel on Climate Change.
 - Far North Science Advisory Panel.
 - Ontario's Action Plan on Climate Change.
- Scenario-based reaction plans.
 - MNR Cochrane District response plan to orphaned Polar Bear cubs (2010).

2.0 RECOVERY

2.1 Recovery Goal

The recovery goal for Polar Bears in Ontario is to have a viable sub-population that can persist in a changing environment and supports traditional uses of Polar Bears by coastal Cree communities.

2.2 Protection and Recovery Objectives

Table 2. Protection and recovery objectives.

No.	Protection or Recovery Objective
1	Reduce the impact of global climate change within Ontario.
2	Identify, protect and adaptively co-manage Polar Bear habitat in Ontario.
3	Conduct research to fill knowledge gaps that will aid in the recovery and protection of Polar Bears and their habitat.
4	Maximize Cree and Ontario's participation in inter-jurisdictional Polar Bear management and research in the Hudson and James Bay eco-region.
5	Develop and implement effective monitoring strategies for Polar Bear, including community based monitoring.
6	Minimize incidental mortalities of Polar Bears.
7	Enhance communication and information sharing with coastal Cree communities and stakeholder groups on Polar Bear biology and management.
8	Explore viable, sustainable and complementary activities to existing traditional harvesting of Polar Bear.

2.3 Approaches to Recovery

Table 3. Approaches to recover Polar Bear in Ontario

Relative Priority	Relative Timeframe	Recovery Theme	Approach to Recovery	Threats or Knowledge Gaps Addressed
1. Reduce the impact of global climate change within Ontario				
<i>Critical</i>	<i>Ongoing</i>	<i>Stewardship</i>	1.1 Promote and set greenhouse gas reduction targets in Ontario - Promote and take action to achieve Ontario's Greenhouse Gas (GHG) targets of 15% below 1990 levels by 2020 and 80% below 1990 levels by 2050 (see www.gogreenontario.ca). - Support green energy initiatives in Ontario while limiting cumulative effects. - Follow recommendations for climate change adaptation including the completion of a provincial strategy and action plan (Pearson and Burton 2009) including such actions as outlined in The Known and Potential Effects of Climate Change on Biodiversity in Ontario's Terrestrial Ecosystems: Case Studies and Recommendations for Adaptation, MNR Climate Series Reports (Varrin et al. 2007). - Work with Far North communities to undertake ecosystem vulnerability analyses to help plan and enable flexible and adaptive management approaches into Polar Bear management as well as broader resource management and policy in areas of Polar Bear habitat.	<i>Threats:</i> Climate Change

Recovery Strategy for Polar Bear in Ontario

Relative Priority	Relative Timeframe	Recovery Theme	Approach to Recovery	Threats or Knowledge Gaps Addressed
<i>Beneficial</i>	<i>Short-term</i>	<i>Management</i>	1.2 Review current environmental legislation regarding pollution control and develop new initiatives and targets to ensure best practices are in place - Implement recommendations from the report “Adapting to Climate Change in Ontario” (Pearson and Burton 2009). - Implement recommendations from the report “Science for a Changing Far North” (The Far North Science Advisory Panel 2010).	<i>Threats:</i> Climate Change
<i>Beneficial</i>	<i>Ongoing</i>	<i>Management</i>	1.3 Create regional strategic visions or regional strategic environmental assessments to help address the impacts/goals of multiple policies Use a standardized method such as the Strategic Environmental Assessment (SEA; www.sea-info.net) to ensure sustainable development through public planning and policy.	<i>Threats:</i> - Climate Change - Cumulative Effects
2. Identify, protect and adaptively co-manage Polar Bear habitat				
<i>Critical</i>	<i>Ongoing</i>	<i>Protection Management</i>	2.1 Develop guiding documents to help inform management and policy decisions within Polar Bear habitat Develop and circulate best management practices to reduce the impacts of development activities, such as mineral exploration, within Polar Bear habitat.	<i>Threats:</i> - Bear-human interactions - Potential for Unsustainable Harvest - Residential and Commercial Development <i>Knowledge Gaps:</i> - All Knowledge Gaps

Recovery Strategy for Polar Bear in Ontario

Relative Priority	Relative Timeframe	Recovery Theme	Approach to Recovery	Threats or Knowledge Gaps Addressed
<i>Necessary</i>	<i>Ongoing</i>	<i>Research</i> <i>Monitoring and Assessment</i> <i>Protection</i> <i>Management</i>	2.2 Spatially assess cumulative impact of threats to Polar Bear in Ontario - Develop spatial risk model to estimate areas where Polar Bear habitat is most likely to be compromised from threats and cumulative effects. - Perform risk assessment of cumulative impacts resulting from development (and associated roads) within the Hudson Bay lowlands to inform environmental assessments and land use planning initiatives. - Collaborate with coastal Cree communities and integrate information into community plans and provincial documents.	<i>Threats:</i> - All Threats <i>Knowledge Gaps:</i> - All Knowledge Gaps
<i>Necessary</i>	<i>Ongoing</i>	<i>Research</i> <i>Monitoring and Assessment</i> <i>Protection</i> <i>Management</i>	2.3 Continue research to refine knowledge of the use of dens and resting areas by Polar Bear - Describe known maternal denning and resting habitat. - Map known distribution of denning and resting habitat. - Review habitat use every fifteen years with scientific experts and coastal Cree communities and revise habitat regulation as necessary.	<i>Threats:</i> - All Threats <i>Knowledge Gaps:</i> - Natural Life History - Current Distribution and Population Trends - Habitat Needs - Human-Bear Interactions
<i>Critical</i>	<i>Short-term</i>	<i>Research</i> <i>Management</i>	2.4 Refine assessment of climate change impacts on the persistence of Polar Bear in Ontario Create or obtain analysis of climate models for the Southern Hudson Bay sub-population to inform management and land use planning decisions.	<i>Threats:</i> - Climate Change - Cumulative Effects <i>Knowledge Gaps:</i> - Current Distribution - Habitat Needs - Emergency Response Plan

Recovery Strategy for Polar Bear in Ontario

3. Conduct research to fill knowledge gaps that will aid in the recovery and protection of Polar Bears and their habitat				
<i>Critical</i>	<i>Short-term</i>	<i>Research Protection</i>	3.1 Investigate the effects of research methods that address population dynamics and habitat monitoring on Polar Bears • Further investigate potential research implications (e.g., drugging, handling) on Polar Bears. • Explore alternative methods to address population dynamics and habitat monitoring.	<i>Knowledge Gaps:</i> • Research Impacts
<i>Critical</i>	<i>Ongoing</i>	<i>Research Protection</i>	3.2 Conduct research to address knowledge gaps and continue with population dynamics and habitat monitoring. • Continue to use GPS collars to determine and/or refine research on denning areas and monitor individual movement and on/off ice dates. • Determine survival rates of Southern Hudson Bay sub-population Polar Bears to help monitor population trends.	<i>Threats:</i> • Human-bear Interaction <i>Knowledge Gaps:</i> • All Knowledge Gaps
<i>Critical</i>	<i>Ongoing</i>	<i>Research</i>	3.3 Investigate the socio-economic impacts of the Polar Bear decline • Conduct research to identify use and economic reliance of coastal Cree communities on Polar Bear. • Encourage ongoing collection of Aboriginal Traditional Knowledge	<i>Knowledge Gaps:</i> • Socio-economics
<i>Necessary</i>	<i>Short-term</i>	<i>Research Management Protection</i>	3.4 Continue to identify key research needs and knowledge gaps to ensure the best scientific and Aboriginal traditional knowledge is used in the co-management of Polar Bear	<i>Threats:</i> • All Threats <i>Knowledge Gaps:</i> • All Knowledge Gaps

Recovery Strategy for Polar Bear in Ontario

<i>Necessary</i>	<i>Short-term</i>	<i>Research Management Protection</i>	3.5 Through a co-management group develop guidelines for tourism operators interacting with Polar Bears - Proactively create guidelines and best management practices in the anticipation of Polar Bear-based tourism activities (e.g. the Manitoba Resource Tourism Operators Act (C.C.S.M. c.R119.5). - Research if there are any potential impacts of tourism on Polar Bears. Include findings in tourism best management practices.	<i>Knowledge Gaps:</i> Tourism
<i>Necessary</i>	<i>On-going</i>	<i>Research Management Protection</i>	3.6 Research annual variation in terrestrial foraging by Polar Bears. Research changes in terrestrial food sources, opportunistic feeding, aquatic foraging and incidences of cannibalism.	<i>Knowledge Gaps:</i> Natural Life History Information
4. Maximize Cree and Ontario's participation in interjurisdictional Polar Bear research and management in the Hudson Bay eco-region				
<i>Critical</i>	<i>Ongoing</i>	<i>Communication Management</i>	4.1 Enhance Ontario and Cree's participation in interjurisdictional Polar Bear management and monitoring. - Organize and participate in face to face meetings with the partners (i.e. coastal Cree communities and all levels of governments) to discuss Polar Bear management, needs and interactions with the communities. - Continue to participate in interjurisdictional meetings with the goal of coordinating research and joint monitoring.	<i>Threats:</i> - All Threats <i>Knowledge Gaps:</i> - All Knowledge Gaps

Recovery Strategy for Polar Bear in Ontario

<i>Necessary</i>	<i>Short-term</i>	<i>Communication Management</i>	4.2 Increase communication and collaboration with jurisdictions that co-manage the Southern Hudson Bay and Western Hudson Bay sub-populations of Polar Bears • Coordinate long-term monitoring and science efforts between jurisdictions. • Initiate consensus building between jurisdictions around determining population numbers in Southern Hudson Bay and Western Hudson Bay and the coordination of harvest management for each sub-population.	<i>Threats:</i> • All Threats <i>Knowledge Gaps:</i> • All Knowledge Gaps
<i>Beneficial</i>	<i>Short-term</i>	<i>Monitoring and Assessment Research</i>	4.3 Assess biological linkages between the Southern Hudson Bay sub-population and the Western Hudson Bay and Foxe Basin sub-populations.	<i>Threats:</i> Potential for Unsustainable Harvest <i>Knowledge Gaps:</i> • Current Distribution and Population Trends

Recovery Strategy for Polar Bear in Ontario

5. Develop and implement effective monitoring strategies for Polar Bear, including community-based monitoring.				
<i>Critical</i>	<i>Ongoing</i>	<i>Research Monitoring</i>	5.1 Intensify monitoring of body condition, population trends and population size • Investigate alternative methods to assess body condition, population trends and population size. • Coordinate with the Federal-Provincial-Territorial Polar Bear Technical Committee (PBTC) as well as Cree, Nunavut and Quebec governments to analyze harvest data for the Southern Hudson Bay sub-population. • Conduct regular monitoring to follow trends in changing body conditions especially female reproduction and cub survival. • Establish a baseline disease and parasite exposure dataset. • Intensify sampling for heavy metals and POPs in Polar Bear habitat and Polar Bear fat tissues. • Continue to communicate research findings through such venues as the State of the Resource Reporting by the Ontario Ministry of Natural Resources in both English and James Bay Cree.	<i>Threats:</i> • All Threats <i>Knowledge Gaps:</i> • All Knowledge Gaps
<i>Critical</i>	<i>Short-term</i>	<i>Management</i>	5.2 Co-management team (i.e. Ontario and Cree coastal Cree communities) develop scenario-based planning • Develop a scenario-based reaction plan for coordinated reaction, monitoring, research and determination of sudden events or mortality events (e.g., drastic decline in body condition, mass mortality events, oil or gas spills, etc.). • Explore protection and compensation measures	<i>Threats:</i> • All Threats <i>Knowledge Gaps:</i> • Emergency Response Plan

Recovery Strategy for Polar Bear in Ontario

<i>Necessary</i>	<i>Ongoing</i>	<i>Research</i>	5.3 Establish a community-based monitoring program • Establish a program to quantify, monitor and map Polar Bear encounters throughout their range. • Record Polar Bear body condition using a standardized protocol developed with local Aboriginal Traditional Knowledge (e.g. of a chart developed by Polar Bears International and World Wildlife Fund (WWF) body condition chart (Appendix Two)). • Record spatial-temporal distribution, habitat use, movement and numbers of Polar Bears in Ontario. • Establish a community-based reporting program for harvest over and above harvest reported to and funded by MNR through pelts sealed for sale. • Create a monitoring program in collaboration with Quebec, to monitor the number of polar bear killed annually for the harvest and incidental purposes.	<i>Threats:</i> • All Threats <i>Knowledge Gaps:</i> • All Knowledge Gaps
<i>Necessary</i>	<i>Short-term</i>	<i>Management</i>	5.4 Co-management team to develop a best management practice document or guideline to inform development activities (i.e., mineral exploration and development), within Polar Bear habitat. This document should include a component on removing or reducing Polar Bear attractants.	<i>Threats:</i> • All Threats

Recovery Strategy for Polar Bear in Ontario

6. Minimize incidental mortalities of Polar Bears.				
<i>Necessary</i>	<i>Short-term</i>	<i>Management Communication</i>	6.1 Support coastal Cree communities in the development and implementation of community-based management plans and best management practices to reduce the frequency of human-bear interactions. • Establish a joint Ontario-First Nation community action team. • Develop a best practices guide to reduce incidental take of Polar Bears including attractant management, deterrence and property protection. • Ontario to support the development of community response plans, individualized for each community. Create a compensation program for property damage caused by Polar Bears.	<i>Threats:</i> • Human-bear Interaction <i>Knowledge Gaps:</i> • All Knowledge Gaps
<i>Necessary</i>	<i>Short-term/ Ongoing</i>	<i>Management Outreach and Communication</i>	6.2 Create local patrol and management groups to minimize incidental mortalities • Work with northern communities to identify current approaches and needs for dealing with human-bear interactions. • Support local representatives in the development and delivery of education programs on methods to protect people while Polar Bears are on land. • Engage experts to demonstrate techniques used to reduce incidental take in coastal Cree communities.	<i>Threats:</i> • Human-bear Interaction <i>Knowledge Gaps:</i> • Human-bear Interactions • Emergency Response Plan

Recovery Strategy for Polar Bear in Ontario

<i>Necessary</i>	<i>Short-term</i>	<i>Management</i>	6.3 Work with residents of mining camps, communities and other stakeholders to evaluate Polar Bear use of landfill sites, and, if necessary, develop protocols to reduce any actual issues • Develop attractant and landfill management protocols. • Implement improved standards at landfills within the Polar Bear range to reduce human-bear conflicts, including at temporary camps, stations and communities.	<i>Threats:</i> • Human-bear Interaction <i>Knowledge Gaps:</i> • Human/Bear Interactions
7. Enhance communication and information sharing with coastal Cree communities and stakeholder groups on Polar Bear biology and management.				
<i>Critical</i>	<i>Ongoing</i>	<i>Education and Outreach</i>	7.1 Work with coastal Cree communities, government agencies and researchers to create a Polar Bear co-management committee.	<i>Threats:</i> • Bear-human interactions • Potential for Unsustainable Harvest • Residential and Commercial Development <i>Knowledge Gaps:</i> • All Knowledge Gaps

Recovery Strategy for Polar Bear in Ontario

<i>Necessary</i>	<i>Ongoing</i>	<i>Education and Outreach</i>	7.2 Explore opportunities with coastal Cree communities to develop a local outreach and engagement program • Initiate a forum for regular information sharing between Ontario and northern coastal Cree communities. • Support the important cultural, spiritual and economic values of Polar Bear to coastal Cree communities. • Work with communities to ensure reporting of all human-caused mortality of Polar Bears (e.g., protection of property) in addition to harvest captured through sealing and sale of hides. • Work with coastal Cree communities and inter-jurisdictional governments to protect female Polar Bears occupying or constructing a den and/or any bear that is part of a family group. Initiate an agreement for not harvesting females in dens and family groups (i.e., females with cubs and/or yearlings) throughout the Southern Hudson Bay and Western Hudson Bay sub-populations range.	<i>Threats:</i> • Bear-human interactions • Potential for Unsustainable Harvest • Residential and Commercial Development <i>Knowledge Gaps:</i> • All Knowledge Gaps

Recovery Strategy for Polar Bear in Ontario

<i>Beneficial</i>	<i>Short-term</i>	<i>Education and Outreach</i>	7.3 Develop province-wide Polar Bear outreach and education programs to broaden the understanding of threats to Polar Bear and emphasize what actions individuals can take to help reduce threats to Polar Bear - Promote information dissemination through various mediums, including new technology and social networks. - Create curriculum-based materials for schools using local Aboriginal Traditional Knowledge and science. - Identify actions that individuals can take to help reduce threats to Polar Bear. Translate outreach materials into Cree and French for maximum effectiveness.	<i>Threats:</i> All Threats
<i>Beneficial</i>	<i>Short-term</i>	<i>Communication Research</i>	7.4 Encourage partnership between coastal Cree communities and government agencies to develop “Green Coastal Communities” pilot initiative to explore viable green initiatives in the northern environment - Identify reasonable renewable energy alternatives for northern communities. - Initiate an incentive program for northern communities to lessen the costs of changing from non-renewable technology to renewable energy alternatives.	<i>Threats:</i> Climate Change
8. Explore viable, sustainable and complementary activities to existing traditional harvesting of Polar Bear.				
<i>Beneficial</i>	<i>Short-term</i>	<i>Protection</i> <i>Education and Outreach</i>	8.1 Develop and manage a Polar Bear viewing industry in collaboration with the Ontario Government within interested First Nation communities (e.g., Fort Severn).	<i>Threats:</i> Biological Resource Use

2.4 Area for Consideration in Developing a Habitat Regulation

Under the ESA, a recovery strategy must include a recommendation to the Minister of Natural Resources on the area that should be considered in developing a habitat regulation. A habitat regulation is a legal instrument that prescribes an area that will be protected as the habitat of the species. The recommendation provided below by the authors will be one of many sources considered by the Minister when developing the habitat regulation for this species.

The Ontario Ministry of Natural Resources is committed to working respectfully and collaboratively with First Nations on the protection of Polar Bear habitat in Ontario. In implementing the requirements of the ESA, Ontario will respect the exercise of constitutionally protected Aboriginal and treaty rights and meet any obligations to consult. The protection of Polar Bear habitat in Ontario will be consistent with the recognition and affirmation of existing Aboriginal and treaty rights in section 35 of the Constitution Act, 1982, including the duty to consult.

Ontario's Polar Bears are dependent on sea ice as habitat, especially for hunting and mating (approximately November to June) as recognized by scientists and coastal Cree communities. However, Ontario does not have jurisdiction over waters of either Hudson Bay or James Bay. Polar Bears are also dependent on terrestrial habitat during the ice-free season or for maternity denning – areas where Ontario does have jurisdiction. Therefore, this recommendation is confined to Polar Bear habitat in terrestrial areas of Ontario.

Polar Bears are found in high densities along the Ontario coast of Hudson Bay and the western coast of James Bay north of Attawapiskat during the ice-free season, typically between July and December (Obbard and Walton 2004, Stirling et al. 2004, Obbard pers. comm. 2010). This area is critically important as summer retreat and resting habitat for subadults, adult males, family groups and non-pregnant females and contains locations where Polar Bears stage in advance of ice forming in the fall. It is anticipated that terrestrial land use will become even more important given expected changes in the timing and extent of summer sea ice in this region (Durner et al. 2009). Therefore, it is recommended that the Ontario coastline from the Manitoba border to Ekwan Point in James Bay and extending 5 km inland, be prescribed as Polar Bear habitat in a habitat regulation for Polar Bears under the ESA. A distance of 5 km was derived from aerial surveys and capture data which show high concentrations of staging Polar Bears within 5 km of the shoreline (Obbard unpub. data). The community of Fort Severn, including a 5 km area around it (i.e., the boundary of the community plus 5 km), should be excluded from the area prescribed in the habitat regulation since this represents unsuitable habitat for Polar Bears due to human development (i.e., housing and community infrastructure, airport, landfill). Other coastal Cree communities such as Peawanuck, Attawapiskat, Fort Albany, Kashechewan and Moosonee/Moose Factory are excluded from the habitat regulation recommendation as they are greater than 5 km inland from the coastline or are south of Ekwan Point.

Recovery Strategy for Polar Bear in Ontario

Beyond the 5 km coastal area, active dens and features that are unoccupied but appear suitable for denning should also be prescribed as Polar Bear habitat. Palsas over 1.5 m tall, eskers, elevated beach ridges and peat banks surrounding lakes within 120 km of the coast should be prescribed as habitat. It is also recommended that 500 m around active dens also be prescribed as Polar Bear habitat so as to minimize disturbance and the potential for den abandonment. The area between the Winisk and Severn Rivers is of particular importance for denning due to the high density of suitable palsas in the area (Obbard and Walton 2004).

There is little information on sensitivity of denning Polar Bears to disturbance (Blix and Lentfer 1992, Armstrup 1993). As such, the following recommendation is based on research from Polar Bears as well as similar species, such as Grizzly and Black Bears (*Ursus arctos* and *U. americanus* respectively). Depending on the activity, most bears respond to disturbance between 200 m and 1 km of the den (Linnell et al. 2000), with Polar Bears responding to disturbance up to 500 m of a denning site (Blix and Lentfer 1992, Amstrup 1993). Therefore, it is recommended that a 500 m radius around active dens is also prescribed as habitat.

The habitat needs for Polar Bears will undoubtedly shift with a changing climate. Their reliance on terrestrial areas is expected to increase with earlier melting of sea ice in summer and later forming of sea ice in fall. Key aspects of the terrestrial habitat itself are forecast to change, sometimes dramatically (melting of palsas, inability of palsas to form, increased frequency/intensity of wildfires). Therefore, it is recommended that the habitat regulation be reviewed on a regular basis with scientific experts and coastal Cree communities and that a monitoring program is developed to track key parameters and trends relating to Ontario Polar Bears and their habitat.

GLOSSARY

Ablation: the opposite of accumulation—refers to all processes that remove snow, ice, or water from a glacier or snowfield.

Committee on the Status of Endangered Wildlife in Canada (COSEWIC): The committee responsible for assessing and classifying species at risk in Canada.

Committee on the Status of Species at Risk in Ontario (COSSARO): The committee established under section 3 of the *Endangered Species Act, 2007* that is responsible for assessing and classifying species at risk in Ontario.

Conservation status rank: A rank assigned to a species or ecological community that primarily conveys the degree of rarity of the species or community at the global (G), national (N) or subnational (S) level. The national and subnational levels are provided for Canada and Ontario respectively. These ranks, termed G-rank, N-rank and S-rank, are not legal designations. The Conservation status of a species or ecosystem is designated by a number from 1 to 5, preceded by the letter G, N or S reflecting the appropriate geographic scale of the assessment. The numbers mean the following:

- 1 = critically imperilled
- 2 = imperilled
- 3 = vulnerable
- 4 = apparently secure
- 5 = secure

Endangered Species Act, 2007 (ESA): The provincial legislation that provides protection to species at risk in Ontario.

Fidelity: the degree to which an organism stays in one type of environment.

Habitat fragmentation: the emergence of discontinuities (fragmentation) in an organism's preferred environment or habitat. The term habitat fragmentation includes the following: (1) reduction in the total area of the habitat; (2) decrease of the interior : edge ratio; (3) isolation of one habitat fragment from other areas of habitat; (4) breaking up of one patch of habitat into several smaller patches; (5) decrease in the average size of each patch of habitat.

Palsa: permafrost landforms that range in height from 1 to 10 metres and protrude above the ground of boreal and subarctic peatlands

Species at Risk Act (SARA): The federal legislation that provides protection to species at risk in Canada. This act establishes Schedule 1 as the legal list of wildlife species at risk to which the SARA provisions apply. Schedules 2 and 3 contain lists of species that at the time the act came into force needed to be reassessed.

Recovery Strategy for Polar Bear in Ontario

After species on Schedule 2 and 3 are reassessed and found to be at risk, they undergo the SARA listing process to be included in Schedule 1.

Species at Risk in Ontario (SARO) List: The regulation made under section 7 of the *Endangered Species Act, 2007* that provides the official status classification of species at risk in Ontario. This list was first published in 2004 as a policy and became a regulation in 2008.

Subnivean: The zone or layer under snow.

Viable: A population that has the estimated numbers and distribution of reproductive individuals to ensure the continued existence of the species throughout its existing range in a planning area.

REFERENCES

- Amstrup, S.C. 1993. Human disturbances of denning polar bears in Alaska. *Arctic* 46:246-250.
- Amstrup, S.C. 2003. Polar bear. Pp. 587–610 in *Wild mammals of North America: biology, management, and conservation*. 2nd Edition. G.A. Feldhamer, B.C. Thompson, and J.A. Chapman (eds). John Hopkins University Press, Baltimore, MD.
- Amstrup, S.C., I. Stirling, T.S. Smith, C. Perham, and G.W. Thiemann. 2006. Recent observations of intraspecific predation and cannibalism among polar bears in the southern Beaufort Sea. *Polar Biology* 29: 997-1002.
- Amstrup, S.C., B.G. Marcot, and D.C. Douglas. 2007. Forecasting the rangewide status of polar bears at selected times in the 21st century. Administrative Report, U.S. Department of the Interior-U.S. Geological Survey, Reston, VA.
- Amstrup, S.C., H. Caswell, E. DeWeaver, I. Stirling, D.C. Douglas, B.G. Marcot, and C.M. Hunter. 2009. Rebuttal of “Polar bear population forecasts: A public-policy forecasting audit.” *Interfaces* 39(4): 353-369.
- Barrie, L.A., D. Fisher, and R.M. Koerner. 1985. Twentieth century trends in Arctic air pollution revealed by conductivity and acidity observations in snow and ice in the Canadian High Arctic. *Atmospheric Environment* 19: 2055-2063.
- Bethke, R., M.K. Taylor, S.C. Amstrup, F. Messier. 1996. Population delineation of polar bears using satellite collar data. *Ecological Applications* 6, 311–317.
- Bergen, S., G.M. Durner, D.C. Douglas, and S.C. Amstrup. 2007. Predicting movements of female polar bears between summer ice foraging habitats and terrestrial denning habitats of Alaska in the 21st Century: Proposed methodology and pilot assessment. Administrative Report. U.S. Geological Survey, Reston. 20 pp.
- BESIS. 1997. The impacts of global climate change in the Bering Sea region. Bering Sea Impacts Study (BESIS). International Arctic Science Committee. Oslo, Norway. vi + 41 pp.
- Blix, A.S., and J.W. Lentfer. 1992. Noise and vibration levels in artificial polar bear dens as related to selected petroleum-exploration and developmental activities. *Arctic* 45: 20-24.
- Brousseau, C.S. and G.A. Goodchild. 1989. Fisheries and yields in the Moose River Basin, Ontario. *In* *Proceedings of the International Large River Symposium*. Can. Spec. Publ. Fish. Aquat. Sci. 106. *Edited by* D.P. Dodge. p145-158.

Recovery Strategy for Polar Bear in Ontario

- Burek, K.A., Gulland, F.M.D. and T. O'Hara. 2008. Effects of climate change on Arctic Marine Mammal Health. *Ecological Applications* 18: S126-S134.
- Calvert, W., and I. Stirling. 1990. Interactions between polar bears and overwintering walrus in the central Canadian High Arctic. *International Conference on Bear Research and Management* 8: 351-356.
- CARC (Canadian Arctic Resources Committee). 2010. Website: www.carc.org Accessed November 21, 2010.
- CBC (Canadian Broadcasting Corporation). 2011. Quebec to host polar bear meeting amid concerns. Available: www.cbc.ca/news/canada/north/story/2011/04/06/quebec-hudson-bay-polar-bear.html. Accessed April 2011.
- Cherry, S.G., A.E. Derocher, K.A. Hobson, I. Stirling and G.W. Thiemann. 2011. Quantifying dietary pathways of proteins and lipids to tissues of a marine predator. *Journal of Applied Ecology* 48: 373-381.
- Cohen, S.J. 1997. What if and so what in northwest Canada: Could climate change make a difference to the future of the Mackenzie basin? *Arctic* 50: 293–307.
- Crompton, A.E., M.E. Obbard, S.D. Petersen, and P.J. Wilson. 2008. Population genetic structure in polar bears (*Ursus maritimus*) from Hudson Bay, Canada: Implications of future climate change. *Biological conservation* 141: 2528-2539.
- Cronin, M.A., S.C. Amstrup, and K.T. Scribner. 2006. Microsatellite DNA and mitochondrial DNA variation in polar bears (*Ursus maritimus*) from the Beaufort and Chukchi Seas, Alaska. *Canadian Journal of Zoology* 84: 655–660.
- COSEWIC. 2008. COSEWIC assessment and update status report on the polar bear *Ursus maritimus* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vii + 75 pp.
- DeMaster, D.P. and I. Stirling. 1981. *Ursus maritimus*. Polar bear. *Mammalian Species* 145:1-7.
- Derocher, A.E., unpublished data. 2010. Edmonton, AB: University of Alberta.
- Derocher, A.E., and I. Stirling. 1990. Distribution of polar bears (*Ursus maritimus*) during the ice-free period in western Hudson Bay. *Canadian Journal of Zoology* 68: 1395-1403.
- Derocher, A.E., and I. Stirling. 1994. Age-specific reproductive-performance of female polar bears (*Ursus maritimus*). *Journal of Zoology* 234: 527-536.

Recovery Strategy for Polar Bear in Ontario

- Derocher, A.E., and I. Stirling. 1998. Maternal investment and factors affecting offspring size in polar bears (*Ursus maritimus*). *Journal of Zoology* 245: 253-260.
- Derocher, A. E., and Ø. Wiig. 1999. Infanticide and cannibalism of juvenile polar bears (*Ursus maritimus*) in Svalbard. *Arctic* 52: 307–10.
- Derocher, A.E., I. Stirling, and D. Andriashek. 1992. Pregnancy rates and serum progesterone levels of polar bears in western Hudson Bay. *Canadian Journal of Zoology* 70: 561-566.
- Derocher, A.E., Andriashek, D. and I. Stirling. 1993. Terrestrial Foraging by Polar Bears during the Ice-Free Period in Western Hudson Bay. *Arctic*. 46: 251-254.
- Derocher, A. E., I. Stirling, and W. Calvert. 1997. Male-biased harvesting of polar bears in western Hudson Bay. *Journal of Wildlife Management* 61: 1075–1082.
- Derocher, A.E., Ø. Wiig, and M. Andersen. 2002. Diet composition of polar bears in Svalbard and the western Barents Sea. *Polar Biology* 25: 448-452.
- Derocher, A.E., H. Wolkers, T. Colborn, M. Schlabach, T.S. Larsen and Ø. Wiig. 2003. Contaminants in Svalbard polar bear samples archived since 1967 and possible population level effects. *The Science of the Total Environment* 301: 163-174.
- Derocher, A.E., N.J. Lunn, and I. Stirling. 2004. Polar Bears in a warming climate. *Integrative and Comparative Biology* 44: 163-176.
- Derocher, A.E., M. Andersen, and Ø. Wiig. 2005. Sexual dimorphism of polar bears. *Journal of Mammalogy* 876: 895-901.
- Derocher, A.E., M. Andersen, Ø. Wiig, and J. Aars. 2010. Sexual dimorphism and the mating ecology of polar bears (*Ursus maritimus*) at Svalbard. *Behavioural Ecology and Sociobiology* 64: 939-946.
- Dowsley, M. 2007. Inuit Perspectives on Polar Bears (*Ursus maritimus*) and Climate Change in Baffin Bay, Nunavut, Canada. *Research and Practice in Social Sciences*. 2: 53-74.
- Durner, G. M., D.C. Douglas, R.M. Neilson, S.C. Amstrup, T.L. McDonald, I. Stirling, M. Mauritzen, E.W. Born, Ø. Wiig, E. DeWeaver, M.C. Serreze, S.E. Belikov, M.M. Holland, J. Maslanik, J. Aars, D.A. Bailey, A.E. Derocher (2009) Predicting 21st-century polar bear habitat distribution from global climate models. *Ecological Monographs* 79: 25-58.
- Dyck, M.G. 2006. Characteristics of polar bears killed in defence of life and property in Nunavut, Canada, 1970–2000. *Ursus* 17: 52–62.

Recovery Strategy for Polar Bear in Ontario

- Dyck, M.G., and K.J. Daley. 2002. Cannibalism of a Yearling Polar Bear (*Ursus maritimus*) at Churchill, Canada. *Arctic* 55: 190-192.
- Dyck, M.G., and E. Kebreab. 2009. Estimating the Energetic Contribution of Polar Bear (*Ursus maritimus*) Summer Diets to the Total Energy Budget. *Journal of Mammalogy*. 90: 585-593.
- Endangered Species Act. 2007. Statutes of Ontario 2007, Chapter 6.
Available at :
www.e-laws.gov.on.ca/html/statutes/english/elaws_statutes_07e06_e.htm
- Engelhardt, F.R. 1983. Petroleum effects on marine mammals. *Aquatic Toxicology* 4: 199-217.
- Ferguson, S.H., M.K. Taylor, E. Born, A. Rosing-Asvid, and F. Messier. 1999. Determinants of Home Range Size for Polar Bears (*Ursus maritimus*). *Ecology Letters* 2: 311–318.
- Ferguson, S.H., M.K. Taylor, and F. Messier. 2000. Influence of sea ice dynamics on habitat selection by polar bears. *Ecology* 81: 761-772.
- Ferguson, S.H., M.K. Taylor, E.W. Born, A. Rosling-Asvid and F. Messier. 2001. Activity and Movement Patterns of Polar Bears inhabiting consolidated versus active pack ice. *Arctic* 54: 49-54.
- Fiori, S.M., and S.M. Zalba. 2003. Potential impacts of petroleum exploration and exploitation on biodiversity in a Patagonian Nature Reserve, Argentina. *Biodiversity and Conservation*. 12: 1261-1270.
- Fish and Wildlife Conservation Act. 1997. Statutes of Ontario 1997, Chapter 41.
Available at
www.e-laws.gov.on.ca/html/statutes/english/elaws_statutes_91f41_e.htm
- Flannigan, M. D., B.J. Stocks, and B.M. Wotton. 2000. Climate change and forest fires. *The Science of the Total Environment* 262: 221–229.
- Forbes, L.B. 2000. The occurrence and ecology of *Trichinella* in marine mammals. *Veterinary Parasitology* 93: 321-334.
- Furnell, D.J. and R.E. Schweinsburg. 1984. Population dynamics of central Canadian Arctic polar bears. *Journal of Wildlife Management* 48: 722-728.
- Garner, G.W., J.F. Evermann, J.T. Saliki, E.H Follmann, and A.J. McKeirnan. 2000. Mirbillivirus ecology in polar bears (*Ursus martimus*). *Polar Biology* 23: 474-478.

Recovery Strategy for Polar Bear in Ontario

- Geraci, J.R. and V.J. Lounsbury. 2005. Marine Mammals Ashore: A Field Guide for Strandings, Second Edition. National Aquarium in Baltimore: Baltimore, MD.
- Gleason, J.S. and K.D. Rode. 2009. Polar bear distribution and habitat association reflect long-term changes in fall sea ice conditions in the Alaskan Beaufort Sea. *Arctic* 62: 405-417.
- Griffiths, D., N.A. Øritzland, and T. Øritzland. 1987. Marine mammals and petroleum activities in Norwegian waters. *Fisken Havet* 1: 1-179.
- Griffin, B. J., K. E. Kohfeld, A. B. Cooper, and G. Boenisch. 2010. Importance of location for describing typical and extreme wind speed behaviour. *Geophysical Resource Letter* 37: 1-6.
- Hammill, M.O., and T.G. Smith. 1991. The role of predation in the ecology of the ringed seal in Barrow Strait, Northwest Territories, Canada. *Marine Mammal Science*. 7: 123-135.
- Harington, C. R. 1968. Denning habits of the polar bear (*Ursus maritimus* Phipps) (Report Series 5). Canadian Wildlife Service, Ottawa.
- Hobson, K.A. and I. Stirling. 1997. Low variation in blood $\delta^{13}\text{C}$ among Hudson Bay polar bears: implications for metabolism and tracing terrestrial foraging. *Marine Mammal Science* 13: 359–367.
- Hobson, K.A., I. Stirling, and D.S. Andriashek. 2009. Isotopic homogeneity of breath CO_2 from fasting and berry-eating polar bears: implications for tracing reliance on terrestrial foods in a changing Arctic. *Canadian Journal of Zoology* 87: 50-55.
- Hunter, C.M., H. Caswell, M.C. Runge, E.V. Regehr, S.C. Amstrup, and I. Stirling. 2010. Climate change threatens polar bear populations: a stochastic demographic analysis. *Ecology* 91: 2883-2897.
- Hunter, George. Personal Communication to C. Chenier. 2010.
- Hurst, F.J. and N.A. Øritzland. 1982. Polar bear thermoregulation: effect of oil on the insulative properties of the fur. *Journal of Thermal Biology* 7: 201-208.
- Hurst, R.J., Watts, P.D., and Øritzland, N.A. 1991. Metabolic compensation in oil-exposed polar bears. *Journal of Thermal Biology* 16: 53-56.
- IUCN. 2010a. Polar Bear Specialist Group, Greenland Institute of Natural Resources. Web site: website: <http://pbsg.npolar.no/en/status/population-map.html> [accessed October 2010]
- IUCN Standards and Petitions Subcommittee. 2010b. Guidelines for Using the

Recovery Strategy for Polar Bear in Ontario

IUCN Red List Categories and Criteria. Version 8.1. Prepared by the Standards and Petitions Subcommittee in March 2010. Web site:

<http://intranet.iucn.org/webfiles/doc/SSC/RedList/RedListGuidelines.pdf>

[accessed November 2010].

Kakekaspan, M., T. Miles, H. Lemelin, M. Dowsley, M. Beaulieu, M. Taylor, F. Siebel, B. Walmark. 2010. Giving Voice to Bear: Cree Observations and Documentation of Wabusk in Ontario: Research Report. Washaho Cree Nation, KORI, Centre for Northern Studies (Thunder Bay). pp 24.

Kakekaspan, G. Personal Observation. Fort Severn First Nation.

Kirk, J.L., and V.L. St. Louis. 2009. Multiyear Total and MethylMercury Exports from Two Major Sub-Arctic Rivers Draining into Hudson Bay, Canada. *Environmental Science and Technology* 43: 2254-2261.

Kolenosky, G. B., and J. P. Prevett. 1983. Productivity and maternity denning of polar bears in Ontario. *International Conference on Bear Research and Management* 5: 238–45.

Kolenosky, G.B., K.F. Abraham, and C.J. Greenwood. 1992. Polar Bears of Southern Hudson Bay. Polar Bear Project, 1984-1988. Ontario Ministry of Natural Resources, Maple, Canada. Final Unpublished Report.

Kucklick, J.R., W.D. Struntz, P.R. Becker, G.W. York, T.M. O'Hara, and J.E. Bohonowych. 2002. Persistent organochlorine pollutants in ringed seals and polar bears collected from northern Alaska. *The Science of the Total Environment* 287: 45-59.

Kucklick, J.R., M.M. Krahn, P.R. Becker, B.J. Porter, M.M. Schantz, G.S. York, T.M. O'Hara, and S.A. Wise. 2006. Persistent organic pollutants in Alaskan Ringed Seal (*Phoca hispida*) and Walrus (*Odobenus Rosmarus*) blubber. *Journal of Environmental Monitoring* 8: 848-854.

Laberge, M., and S. Payette. 1995. Long-Term Monitoring of Permafrost Change in a Palsa Peatland in Northern Quebec, Canada: 1983-1993. *Arctic and Alpine Research* 27: 167-171.

Laidre, K.L, I. Stirling, L.F. Lowry, O. Wii, M.P. Heid-Jorgensen and S.H. Ferguson. 2008. Quantifying the sensitivity of arctic marine mammals to climate-induced habitat change. *Ecological Application* 17: 97-125.

Lemelin, R.H. Personal Communication to M.B. Tonge and T.L. Pulfer. 2010.

Lemelin, R. H., M. Dowsley, B. Walmark, F. Siebel, L. Bird, G. Hunter, T. Myles, M. Mack, M. Gull and M. Kakekaspan. 2010. Wabusk of Omushkegouk: Cree-Polar

Recovery Strategy for Polar Bear in Ontario

- Bear (*Ursus maritimus*) Interactions in Northern Ontario. *Human Ecology*. 38: 803-815.
- Linnell, J.D., J.E. Swenson, R. Andersen, and B. Barnes. 2000. How vulnerable are denning bears to disturbance? *Wildlife Society Bulletin*. 28: 400-413.
- Lipnick, R.L. 2000. Persistent, bioaccumulative, and toxic chemicals I: fate and exposure. American Chemical Society: Washington, D.C. 308 pp.
- Lu, J.Y., W.H. Schroeder, L.A. Barrie, and A. Steffen. 2001. Magnification of atmospheric mercury deposition to polar regions in springtime: the link to tropospheric and ozone depletion chemistry. *Geophysical research letters* 28: 3219-3222.
- Lunn, N. J., S. Schliebe, and E. W. Born, editors. 2002. Polar Bears. Proceedings of the Thirteenth Working Meeting of the IUCN/SSC Polar Bear Specialist Group. Occasional Paper of the IUCN Species Survival Commission No. 26. International Union for Conservation of Nature and Natural Resources, Gland, Switzerland. 153 pp
- Lunn, N.J., M. Branigan, E.L. Carpenter, K. Chaulk, B. Doidge, J. Galipeau, D. Hedman, M. Huot, R. Marag, M. Obbard, R. Otto, I. Stirling, M. Taylor, and S. Woodley. 2006. Polar bear management in Canada 2001– 2004. In: Aars, J., Lunn, N.J., and Derocher, Infonorth. (eds.). Polar bears: Proceedings of the 14th Working Meeting of the IUCN/SSC Polar Bear Specialist Group, 20–24 June 2005, Seattle, Washington, USA. Occasional Paper of the IUCN 32. Gland, Switzerland: Species Survival Commission 117–132.
- Mauritzen, M., A.E. Derocher, and Ø. Wiig. 2001. Space-use strategies of female polar bears in a dynamic sea ice habitat. *Canadian Journal of Zoology* 79: 1704-1713.
- McDonald, M., L. Arragutainaq and Z. Novalinga. 1997. Voices from the Bay: Traditional Knowledge of Inuit and Cree in the Hudson Bay Bioregion. Ottawa: Canadian Arctic Resources Committee.
- McPherson, G., J.R. Simpson, P.J. Peper, S.E. Maco, and Q. Xiao. 2005. Municipal forest benefits and costs in Five US Cities. *Journal of Forestry* 103(8): 411–416.
- Miles, T. Personal Communication to M.B. Tonge and T.L. Pulfer. 2010.
- Monnett, C., and J.S. Gleason. 2006. Observations of mortality associated with extended open-water swimming by polar bears in the Alaskan Beaufort Sea. *Polar Biology* 29: 681-687.
- Obbard, M.E. 2007. Ontario Report to the 39th Meeting of the Federal-Provincial Polar Bear Technical Committee, 6-9 February 2007, Edmonton, Canada. Ontario

Recovery Strategy for Polar Bear in Ontario

Ministry of Natural Resources, Wildlife Research and Development Section,
Peterborough, Canada, Unpublished Report.

Obbard, M.E. Personal Communications to M.B. Tonge and T.L. Pulfer. 2010

Obbard, M.E., unpublished data. 2010. Peterborough, ON: Ontario Ministry of Natural Resources.

Obbard, M.E. and L. R. Walton. 2004. The importance of Polar Bear Provincial Park to the Southern Hudson Bay polar bear population in the context of future climate change. Pp. 105-116 in C. K. Rehbein, J. G. Nelson, T. J. Beechey, and R. J. Payne, editors. Parks and protected areas research in Ontario, 2004: planning northern parks and protected areas. Proceedings of the Parks Research Forum of Ontario Annual General Meeting, May 4-6, 2004, Thunder Bay, ON.

Obbard, M.E., M.R. Cattet, T. Moody, L.R. Walton, D. Potter, J. Ingles, C. Chenier. 2006. Temporal trends in the body condition of southern Hudson Bay Polar Bears. Climate Change: Research Information Note, No 3. Ontario Ministry of Natural Resources. Applied Research and Development Branch. pp 1-8.

Obbard, M.E., T.L. McDonald, E.J. Howe, E.V. Regehr, and E.S. Richardson. 2007. Polar Bear Population Status in Southern Hudson Bay, Canada. Pp. 1-36 in Administrative Report: USGS Science Strategy to Support U.S. Fish and Wildlife Service Polar Bear Listing Decision. U.S. Geological Survey, Reston, Virginia.

Obbard, M.E., Thiemann, G.W., Peacock, E., and DeBruyn, T.D. (eds) (2010). *Polar Bears: Proceedings of the 15th Working Meeting of the IUCN/SSC Polar Bear Specialist Group, Copenhagen, Denmark, 29 June–3 July 2009*. Gland, Switzerland and Cambridge, UK: IUCN. vii + 235 pp. Used with permission

Olsgard, F., and J.S. Gray. 1995. A comprehensive analysis of the effects of offshore oil and gas exploration and production on the benthic communities of the Norwegian continental shelf. Marine Ecology Progress Series 122: 277-306.

OMNR (Ontario Ministry of Natural Resources). 1980. Polar Bear Provincial Park Master Plan. Ontario Ministry of Natural Resources, Toronto, Ontario.

OMNR (Ontario Ministry of Natural Resources). 2008. State of resources reporting: polar bears in Ontario. Web site:
www.mnr.gov.on.ca/stdprodconsume/groups/lr/@mnr/@sorr/documents/docume nt/263710.pdf

Øritsland, N.A., F.R. Engelhardt, F.A. Juck, R.J. Hurst, and P.D. Watts. 1981. Effect of crude oil on polar bears. Environmental Studies. Indian and Northern Affairs 24: 1-268

Recovery Strategy for Polar Bear in Ontario

- Paetkau, D., W. Calvert, I. Stirling, and C. Strobeck. 1995. Microsatellite analysis of population structure in Canadian polar bears. *Molecular Ecology* 4: 347-354.
- Paetkau, D., S.C. Amstrup, E.W. Born, W. Calvert, A.E. Derocher, G.W. Garner, F. Messier, I. Stirling, M.K. Taylor, Ø. Wiig, and C. Strobeck. 1999. Genetic structure of the world's polar bear populations. *Molecular Ecology* 8: 1571–1584.
- Parks, E.K., A.E. Derocher, and N.J. Lunn. 2006. Seasonal and annual movement patterns of polar bears on the sea ice of Hudson Bay. *Canadian Journal of Zoology*. 84: 1281-1294.
- Peacock, E., A. E. Derocher, N. J. Lunn, and M. E. Obbard. 2010. Pp. 93-115. Polar Bear Ecology and Management in Hudson Bay in the Face of Climate Change. In *A little less Arctic*. Springer Science, Toronto.
- Pearson, D. and I. Burton. 2009. Adapting to Climate Change in Ontario: Towards the Design and Implementation of a Strategy and Action Plan. Queen's Printer for Ontario: Toronto, Ontario. 96 pp.
- Poehlmann and Associates. 1997. Synthesis report of the information contained within the geoscience catalogue pertaining to the Moose River Basin with particular reference to the aquatic environment. Ontario Ministry of Natural Resources, Environmental Information Partnership, South Porcupine, ON. 37p. + app.
- Pomeroy, L.R. 1997. Primary production in the Arctic Ocean estimated from dissolved oxygen. *Journal of Marine Sciences* 10: 1-8.
- Pryor, S.C., and R.J. Barthelmie. 2010. Climate change impacts on wind energy: A review. *Renewable and Sustainable Energy Review*. 14: 430-437
- Quakenbush, L., K. Beckmen, and C.D. Brower. 2009. Rehabilitation and release of marine mammals in the United States: Concern from Alaska. *Marine Mammal Science* 25: 994-999.
- Ramsay, M.A. and K.A. Hobson. 1991. Polar Bears make little use of terrestrial food webs: evidence from stable-carbon isotope analysis. *Oecologia* 86: 598-600.
- Ramsay, M.A., and I. Stirling. 1986. On the mating system of polar bears. *Canadian Journal of Zoology* 64:2142-2151.
- Ramsay, M.A., and I. Stirling. 1988. Reproductive biology and ecology of female polar bears (*Ursus maritimus*). *Journal of Zoology (London)* 214:601-634.
- Ramsay, M.A. and I. Stirling. 1990. Fidelity of female polar bears to winter-den sites. *Journal of Mammalogy* 71: 233-236.

Recovery Strategy for Polar Bear in Ontario

- Regehr, E.V., N.J. Lunn, S.C. Amstrup, and I. Stirling. 2007. Effects of earlier sea ice breakup on survival and population size of polar bears in western Hudson Bay. *Journal of Wildlife Management* 71:2673–2683.
- Regehr, E. V., Hunter, C. M., Caswell, H., Amstrup, S. C. and Stirling, I. 2010, Survival and breeding of polar bears in the southern Beaufort Sea in relation to sea ice. *Journal of Animal Ecology* 79:117–127.
- Resource Tourism Operators Act. 2002. Continuing Consolidation of the Statutes of Manitoba. Chapter R119.5. Available at <http://web2.gov.mb.ca/laws/statutes/2002/c04602e.php>
- Reynolds, J.E. III and S.A. Rommel. 1999. Polar Bear (*Ursus Maritimus*). Pp. 218-286. In *Biology of Marine Mammals* (Eds.). Smithsonian Institution Press: Washington, D.C.
- Richardson, E., I. Stirling, and D.S. Hik. 2005. Polar bear (*Ursus maritimus*) maternity denning habitat in western Hudson Bay: a bottom-up approach to resource selection functions. *Canadian Journal of Zoology* 83: 860–870.
- Richardson, E., Stirling I, Kochtubajda B. 2007. The effects of forest fires on polar bear maternity denning habitat in western Hudson Bay. *Polar Biology* 30:369–378.
- Russell, R.H. 1975. The food habits of polar bears of James Bay and Southwest Hudson Bay in summer and autumn. *Arctic* 28:117-129.
- Schliebe, S., Ø. Wiig, A. Derocher and N. Lunn. 2008. *Ursus maritimus*. In: IUCN 2010. IUCN Red List of Threatened Species. Version 2010.4. Web site: www.iucnredlist.org [accessed Nov 2010].
- Simmonds, M.P. and S.J. Issac. 2007. The impacts of climate change on marine mammals: early signs of significant problems. *Oryx* 41:19-26
- Skaare, J.U., H.J. Larsen, E. Lie, A. Bernhoft, A.E. Derocher, R. Norstrom, E. Ropstad, N.F. Lunn, and Ø. Wiig. 2002. Ecological risk assessment of persistent organic pollutants in the arctic. *Toxicology* 181-182: 193-197.
- Smith, T.G. 1980. Polar bear predation of ringed and bearded seals in the landfast sea ice habitat. *Canadian Journal of Zoology* 58:2201-9.
- Smith, T.G. 1985. Polar Bears, *Ursus maritimus*, as predators of belugas, *Delphinapterus leucas*. *Canadian Field Naturalist* 99:71-75.

Recovery Strategy for Polar Bear in Ontario

- Smith, T.G. 1987. The ringed seal, *Phoca hispida*, of the Canadian western Arctic. Canadian Bulletin of Fisheries and Aquatic Sciences. Ottawa. Vi + 81.
- Smith, T.G., and B. Sjare. 1990. Predation of belugas and narwhals by polar bears in nearshore areas of the Canadian High Arctic. Arctic 43:99-102.
- Smith, T.G., and I. Stirling. 1975. The breeding habitat of the ringed seal (*Phoca hispida*): The birth lair and associated structures. Canadian Journal of Zoology 53:1297–1305.
- Smith, T.G., and I. Stirling. 1978. Variation in the density of ringed seal (*Phoca hispida*) birth lairs in the Amundsen Gulf, Northwest Territories. Canadian Journal of Zoology 56:1066–1071.
- Sollid, J.L., and L. Soebel. 1998. Palsa Bogs as a Climate Indicator: Examples from Dovrefjell, Southern Norway. Ambio 27:287-291.
- Sonne, C. 2010. Health effects from long-range transported contaminants in Arctic top predators: An integrated review based on studies of polar bears and relevant model species. Environment International 36: 461-491.
- Stirling, I. 1974. Midsummer observations on the behavior of wild polar bears. Canadian Journal of Zoology 52:1191-1198.
- Stirling, I. 1988. Polar Bears. University of Michigan Press. Ann Arbor, Michigan. vi + 220.
- Stirling, I. 1990. Polar bears and oil: Ecological perspectives. Pages 223–34 in J. R. Geraci and D. J. St. Aubin, eds. Sea mammals and oil: Confronting the risks. Academic Press, San Diego, CA.
- Stirling, I. 1992. Bears of the World. Natural history series. Key Porter Books Limited. Toronto, Ontario. vi + 220.
- Stirling, I. 1997. The importance of polynyas, ice edges, and leads to marine mammals and birds. Journal of Marine Systems. 10: 9-21.
- Stirling, I. 2006. Polar bear. Pp. 580—583 in The Princeton Encyclopedia of Mammals (Macdonald, D.W., ed.). Princeton University Press, Princeton, NJ.
- Stirling, I., and A.E. Derocher. 1993. Possible impacts of climatic warming on polar bears. Arctic 46:240-245.
- Stirling, I., and E.H. McEwan. 1975. The caloric value of whole ringed seals in relation to polar bear ecology and hunting behavior. Canadian Journal of Zoology 53:1021-1027.

Recovery Strategy for Polar Bear in Ontario

- Stirling, I., and N.A. Øritsland. 1995. Relationships between estimates of ringed seal (*Phoca hispida*) and polar bear (*Ursus maritimus*) populations in the Canadian Arctic. *Canadian Journal of Fisheries and Aquatic Sciences* 52:2594-2612.
- Stirling, I., and C.L. Parkinson. 2006. Possible effects of climate warming on selected populations of polar bears (*Ursus maritimus*) in the Canadian Arctic. *Arctic* 59:261-275.
- Stirling, I., and T.G. Smith. 1975. Interrelationships of Arctic Ocean mammals in the sea ice habitat. *Circumpolar Conference on Northern Ecology* 2:129–36.
- Stirling, I., and T.G. Smith. 2004. Implications of warm temperatures and an unusual rain event for the survival of ringed seals on the coast of Southeastern Baffin Island. *Arctic* 57:59-67.
- Stirling, I., W. Calvert, and D. Andriashek. 1980. Population ecology studies of the polar bear in the area of southeastern Baffin Island (Occasional Paper No. 44). Canadian Wildlife Service, Ottawa.
- Stirling, I., W. Calvert, and D. Andriashek. 1984. Polar bear ecology and environmental considerations in the Canadian High Arctic. Pp. 201-222 in: R. Olson, F. Geddes and R. Hastings (Eds.). *Northern Ecology and Resource Management*. University of Atlanta Press.
- Stirling, I., N.J. Lunn and J. Iacozza. 1999. Long-term trends in the population ecology of polar bears in western Hudson Bay in relation to climatic change. *Arctic* 52: 294-306.
- Stirling, I., N.J. Lunn, J. Iacozza, C. Elliott, and M. Obbard. 2004. Polar bear distribution and abundance on the southwestern Hudson Bay coast during open water season, in relation to population trends and annual ice patterns. *Arctic* 57:15-26.
- Stokes, K., S.P. McGovern, and W. Fiset. 1999. Potential impacts of hydroelectric development on aquatic environments: a selected annotated bibliography with emphasis on the Moose River Basin. OMNR, Boreal Science, Northeast Science & Technology, and the Environmental Information Partnership, South Porcupine, Ontario. 164p. + *iii*.
- Taylor, M., B. Elkin, N. Maier and M. Bradley. 1991. Observation of a polar bear with rabies. *Journal of Wildlife Diseases* 27:337-339.
- Taylor, M. and J. Lee. 1995. Distribution and abundance of Canadian polar bear populations - a management perspective. *Arctic* 48: 147-154.
- Taylor, M.K., S. Akeeagok, D. Andriashek, W. Barbour, E. W. Born, W., Calvert, H.D.

Recovery Strategy for Polar Bear in Ontario

- Cluff, S. Ferguson, J. Laake, A. Rosing-Asvid, I. Stirling, F. Messier. 2001. Delineating Canadian and Greenland polar bear (*Ursus maritimus*) populations by cluster analysis of movements. *Canadian Journal of Zoology* 79, 690–709.
- The Far North Science Advisory Panel. 2010. Science for a Changing Far North. The Report of the Far North Science Advisory Panel. A report submitted to the Ontario Ministry of Natural Resources. Queen's Printer for Ontario: Toronto, Ontario. 112 pp.
- Thiemann, G.W., S.J. Iverson, and I. Stirling. 2008. Polar bear diets and arctic marine food webs: insights from fatty acid analysis. *Ecological Monographs* 78:591–613.
- Towns, L., A.E. Derocher, I. Stirling, N.J. Lunn, and D. Hedman. 2009. Spatial and temporal patterns of problem polar bears in Churchill, Manitoba. *Polar Biology* 32:1529–1537.
- Towns, L., A.E. Derocher, I. Stirling, and N.J. Lunn. 2010. Changes in Land Distribution of Polar Bears in Western Hudson Bay. *Arctic* 63:206-212.
- Tynan, C.T. and D.P. DeMaster. 1997. Observations and predictions of Arctic climate change: potential effects on marine mammals. *Arctic* 50: 308-322
- UNEP; Nellemann, C., L. Kullerud, L., I. Vistnes, B.C. Forbes, G. P. KoWnas, B. P. Kaltenborn, O. Grøn, D. Henry, M. Magomedova, C. Lambrechts, T. S. Larsen, P. J. Schei, R. Bobiwash. 2001, GLOBIO—global methodology for mapping human impacts on the biosphere. United Nations Environmental Programme, Nairobi.
- Varrin, R., J. Bowman and P.A. Gray. 2007. The known and potential effects of climate change on biodiversity in Ontario's terrestrial ecosystems: Case studies and recommendations for adaptation. 58 pp.
- Ward, L., G. Silber, R. Baumstark, and T. Pulfer. 2005. Characterization of ship traffic patterns in right whale critical habitat. *Coastal Management* 33: 263-278.
- York, G. 2009. WWF Polar Bear Species Action Plan. DRAFT. *Not yet available online*. Pp. 85,
- Zuidhoff, F. S. and E. Kolstrup. 2000. Changes in palsa distribution in relation to climate change in Laivadalen, northern Sweden, especially 1960–1997. *Permafrost and Periglacial Processes* 11:55–69.

Recovery Strategy for Polar Bear in Ontario

APPENDIX 1

IUCNb Ranking Categories for Threats

Severity of Damage: Level of damage that can reasonably be expected.

Very High	The threat is likely to <i>destroy or eliminate</i> Polar Bear populations and/or habitat over some portion of the target's occurrence
High	The threat is likely to <i>seriously degrade</i> Polar Bear populations and/or habitat over some portion of the target's occurrence
Medium	The threat is likely to <i>moderately degrade</i> Polar Bear populations and/or habitat over some portion of the target's occurrence
Low	The threat is likely to only <i>slightly impair</i> Polar Bear populations and/or habitat over some portion of the target's occurrence

Scope of Damage: The geographic scope of impact on Polar Bears within their range in Ontario that can reasonably be expected.

Very High	The threat is likely to be very <i>widespread or pervasive</i> in its scope, and affect Polar Bears throughout the Polar Bears occurrence within Ontario
High	The threat is likely to be <i>widespread</i> in its scope, and affect Polar Bears at many of the Polar Bears occurrences within Ontario
Medium	The threat is likely to be <i>localized</i> in its scope, and affect the Polar Bears at some of the Polar Bears occurrences within Ontario
Low	The threat is likely to be <i>very localized</i> in its scope, and affect Polar Bears at a limited portion of the Polar Bears occurrences within Ontario

Severity and Scope of Damage Ranking Chart

Scope	Severity			
	Very High	High	Medium	Low
Very High	Very High	High	Medium	Low
High	High	High	Medium	Low
Medium	Medium	Medium	Medium	Low
Low	Low	Low	Low	Low

Irreversibility: The reversibility of the threat.

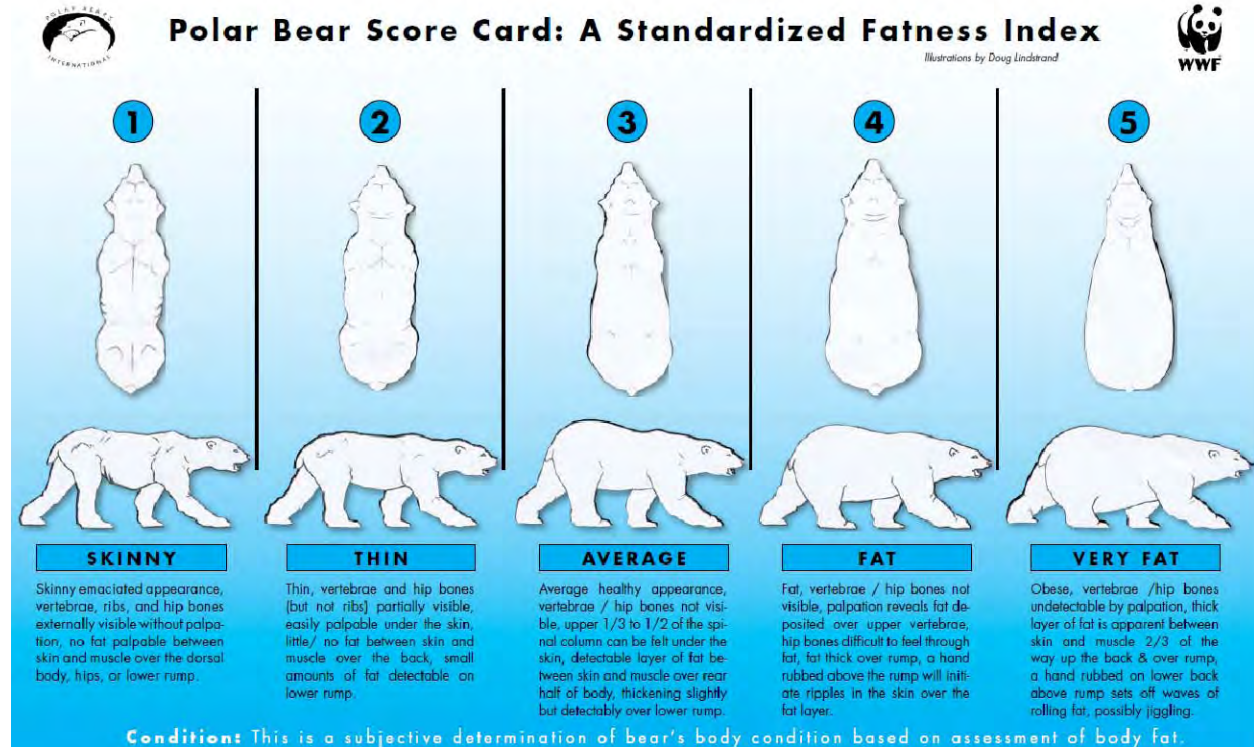
Very High	The threat is <i>not reversible</i> , for all intents and purposes
High	The threat is <i>reversible</i> , but <i>not practically affordable</i>
Medium	The threat is <i>reversible</i> with a <i>reasonable commitment of additional resources</i>
Low	The threat is <i>easily reversible</i> at relatively <i>low cost</i>

Overall Threat Magnitude per Biodiversity Target

Severity & Scope	Irreversibility			
	Very High	High	Medium	Low
Very High	Very High	Very High	Very High	High
High	Very High	High	High	Medium
Medium	High	Medium	Low	Low
Low	Medium	Low	Low	Low

APPENDIX 2

Body Condition Chart produced by Polar Bears International and World Wildlife Fund



**Part 6 – *Management Plan for the Polar Bear*
(*Ursus maritimus*) for Québec, the Eeyou Marine Region and
the Nunavik Marine Region, prepared by the Québec –
Eeyou Marine Region - Nunavik Marine Region
Polar Bear Working Group**

Polar Bear Management Plan for Québec, the Eeyou Marine Region and the Nunavik Marine Region



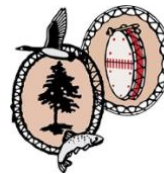
2023-2033



Environment and
Climate Change Canada

Environnement et
Changement climatique Canada

Québec



Comité conjoint de chasse,
de pêche et de piégeage
Hunting, Fishing and Trapping
Coordinating Committee



Management Plan cover photo courtesy of Adamie Delisle-Alaku

Acknowledgements

I would like to acknowledge the support and effort of everyone involved in the creation of this plan and all members of the Québec-Eeyou Marine Region-Nunavik Marine Region Polar Bear Working Group, who spent many hours drafting and reviewing each successive version.

I would especially like to thank all of the Cree and Inuit communities and individuals who participated in all aspects of the consultations for this plan, and who provided invaluable input that made this plan possible.

The creation of the plan would not have proceeded without the generous financial support of Environment and Climate Change Canada (ECCC), the Cree Nation Government (CNG), Makivik Corporation and the Ministère des Forêts, de la Faune et des Parcs (MFFP). Contributions from the Cree Trappers Association, the Eeyou Marine Region Wildlife Board (EMRWB), the Government of Nunavut, the Hunting, Fishing and Trapping Coordinating Committee (HFTCC), the Nunavik Marine Region Wildlife Board (NMRWB) and the Regional Nunavimmi Umajulirijiit Katujjiqatigiinninga (RNUK) were also critical to this process.

Gregor Gilbert

Chair, Québec-Eeyou Marine Region-Nunavik Marine Region Polar Bear Working Group

The Polar Bear Management Plan for Québec, the Eeyou Marine Region, and the Nunavik Marine Region is dedicated to the memory of Mark O'Connor, whose vision, hard work, and perseverance enabled the plan to be realized.

This management plan is the result of a collaborative approach involving representation from each of the following groups:

- Canadian Wildlife Service (CWS), Environment and Climate Change Canada (ECCC)
- Cree Nation Government (CNG)
- Cree Trappers Association (CTA)
- Eeyou Marine Region Wildlife Board (EMRWB)
- Government of Nunavut Department of the Environment (GNDoE)
- Hunting Fishing Trapping Coordinating Committee (HFTCC)
- Makivik Corporation
- Ministère des Forêts, de la Faune et des Parcs (MFFP)
- Nunavik Hunters, Fishermen & Trappers Association / Regional Nunavimmi Umajulirijiit Katujjiqatigiinninga (NHFTA/RNUK)
- Nunavik Marine Region Wildlife Board (NMRWB)

Each of the organizations noted above has appointed representatives to a working group tasked with the creation of this polar bear management plan. Representatives were appointed in their capacity as experts in the field of polar bears or polar bear management, and not in the capacity of representing the views or opinions of their organizations. Consultations were undertaken throughout the region affected by the management plan, and we have endeavoured to make sure all relevant stakeholders have had an opportunity to provide input into the plan. To the extent possible, we have attempted to ensure that Inuit, Cree and scientific perspectives have been reflected appropriately throughout the development of this management Plan.

Plan Duration and Review

The Polar Bear Management Plan for Québec, the Eeyou Marine Region and Nunavik Marine Region will be in effect for a period of 10 years, subject to ongoing monitoring of its effectiveness and a full review and assessment report will be prepared after 5-years. Changes to the management plan may be proposed prior to its expiration should issues be identified in the course of these assessments.

Prior to the end of this 10-year period, a new management plan will be tabled for adoption in accordance with applicable Land Claims Agreements, and all relevant laws and regulations in force at the federal, provincial, and territorial governments. This management plan will remain in effect until a new management plan has been adopted.

Implementation of this plan is subject to budgetary appropriations, priorities, and constraints of the participating management agencies.

Acronyms Used

AEUO	Areas of Equal Use and Occupancy
CAP	Circumpolar Action Plan for polar bear
CI	Confidence Interval
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CNG	Cree Nation Government
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
COY	Cub-of-the-Year
CTA	Cree Trappers' Association
CWS	Canadian Wildlife Service
DLP	Defense of life and property
DS	Davis Strait
ECCC	Environment and Climate Change Canada
EMR	Eeyou Marine Region
EMRLCA	Eeyou Marine Region Land Claims Agreement
EMRWB	Eeyou Marine Region Wildlife Board
FB	Foxe Basin
JBNQA	James Bay and Northern Québec Agreement
HFTA	Hunting, Fishing and Trapping Associations
HFTCC	Hunting, Fishing and Trapping Coordinating Committee
IUCN	International Union for Conservation of Nature
LEMV	Loi sur les espèces menacées ou vulnérables
LNUK	Local Nunavimmi Umajulirijiit Katujjiqatigiinninga
LSA	Labrador Settlement Area
MFFP	Ministère des Forêts, de la Faune et des Parcs (Gouvernement du Québec)
NHFTA	Nunavik Hunters, Fishermen and Trappers Association
NILCA	Nunavik Inuit Land Claims Agreement
NMR	Nunavik Marine Region
NMRWB	Nunavik Marine Region Wildlife Board
NQL	Non-Quota Limitation
NSA	Nunavut Settlement Area
NWMB	Nunavut Wildlife Management Board
PBAC	Polar Bear Administrative Committee
PBTC	Polar Bear Technical Committee
POP	Persistent Organic Pollutant
RNUK	Regional Nunavimmi Umajulirijiit Katujjiqatigiinninga
SARA	Federal Species at Risk Act
SHB	Southern Hudson Bay
TAT	Total Allowable Take
TK	Traditional Knowledge
WAPPRIITA	Wild Animals and Plant Protection and Regulation of International and Interprovincial Trade Act
WAPTR	Wild Animal and Plant Trade Regulations

Glossary of Select Terms Used in this Management Plan

Best Available Information - All existing information that is pertinent to assessing the status of a wildlife species, including scientific knowledge, community knowledge, and Aboriginal Traditional Knowledge that has been subjected to appropriate quality controls and can be obtained from literature sources or from the holders of the information¹

Collaborative management – Process by which polar bear management is achieved through close collaboration between governments, land claims organizations, Indigenous organizations and harvesters. Each party participates, subject to their roles and responsibilities as established by law or by virtue of a Land Claims Agreement, to the development of recommendations, conceptualization of management measures, implementation of the management system and the enforcement of the regulatory framework that arises from it. The success of this process rests on a regular and transparent exchange of information and on the conduct of relevant consultations. The government (federal, provincial or territorial, as the case may be) holds the ultimate authority and responsibility with regards to the management measures in place within its jurisdiction.

Defense of Life and Property (DLP) - A situation where a polar bear has come into contact with humans, their property, or both, and actions are taken to preserve the life of one or more persons or when public safety and property are at stake².

Harvest or Harvesting - The term is used to reflect the definitions included in each of the applicable Land Claim Agreements as follows:

Eeyou Marine Region Land Claims Agreement (EMRLCA)³: “Harvest” or “Harvesting” means the reduction of Wildlife into possession, and includes hunting, trapping, fishing as defined in the Fisheries Act, R.S.C. 1985, c. F-14, netting, egging, picking, collecting, gathering, spearing, killing, capturing or taking by any means.

James Bay and Northern Québec Agreement (JBNQA)⁴: “Harvesting” means hunting, fishing and trapping by the Native people for the purpose of the capture or killing of individuals of any species of wild fauna, except species from time to time completely protected to ensure the continued existence of that species or a population thereof, for personal and community purposes or for commercial purposes related to the fur trade and commercial fisheries.

Nunavik Inuit Land Claims Agreement (NILCA)⁵: “harvest” means the reduction of wildlife into possession and the attempt thereto, and includes hunting, trapping, fishing, netting, egging, picking, collecting, gathering, spearing, killing, capturing or taking by any means.

Healthy population – A population that benefits from a state of biologic, social, and environmental determinants and their interactions that allows its maintenance. For polar bear, these determinants include nutritional condition, physiological stress, and exposure to contaminants, diseases and parasites.

Inuit Qaujimajatuqangit (IQ) - Inuit Qaujimajatuqangit encompasses all aspects of Inuit culture, including values, language, social organization, knowledge, life skills, perceptions and expectations^{8,9}.

Local Knowledge - A collection of facts that relates to the entire system of concepts, beliefs, and perceptions that people hold about the world around them. This includes the way people observe and measure their surroundings, how they solve problems and validate new information. It includes the

processes whereby knowledge is generated, stored, applied and transmitted to others. It is not confined to tribal groups or to the original inhabitants of an area¹⁰.

Management system - Refers to the suite of tools that are used to implement the management framework and management plan, such as tags, quotas, etc.

Non-Quota Limitations (NQL) - A limitation of any kind, except a total allowable take (TAT), including limits imposed on the harvest season, sex, size, or age of wildlife, or the harvest methods.

Principles of Conservation - The Principles of Conservation are defined in each of the applicable Land Claim Agreements as follows:

Eeyou Marine Region Land Claims Agreement³:

- a) the maintenance of the natural balance of ecological systems within the EMR;
- b) the maintenance of vital, healthy Wildlife populations, including maintaining such populations to sustain the Harvesting needs as defined in Part III;
- c) the protection of Wildlife habitat; and
- d) the restoration and revitalization of depleted populations of Wildlife and Wildlife habitat.

James Bay and Northern Québec Agreement⁴:

"Conservation" means the search for the optimal natural productivity of all living resources and the protection of the ecological systems of the Territory so as to protect endangered species and to ensure primarily the continuance of the traditional pursuits of the Native people, and secondarily the satisfaction the needs of non-Native people for sport hunting and fishing.

Nunavik Inuit Land Claims Agreement⁵:

- a) The maintenance of the natural balance of ecological systems within the NMR;
- b) The maintenance of vital, healthy wildlife populations capable of sustaining harvesting needs as defined by the Article;
- c) The protection of wildlife habitat; and
- d) The restoration and revitalization of depleted populations of wildlife and wildlife habitat.

Sustainable Harvesting - A method of harvest or use of a resource in a way and at a rate that does not lead to its long-term decline, thereby maintaining its potential to meet the needs and aspirations of present and future generations¹¹.

Total Allowable Take (TAT) - The NILCA and the EMRLCA define TAT as the amount of a wildlife species that can be legally harvested. The JBNQA uses the term "catch limit" in the same sense (i.e., the maximum number of a species or group of species that a hunter can legally catch). In the context of this management plan, a TAT includes all types of legal harvest, including subsistence harvesting, DLP, and sport hunting.

Traditional Knowledge (TK)- Traditional knowledge is a cumulative body of knowledge, know-how, practices and representations maintained and developed by the peoples over a long period of time. This encompasses spiritual relationships, historical and present relationships with the natural environment, and the use of natural resources. It is generally expressed in oral form, and passed on from generation to generation by story-telling and practical teaching¹².

Table of Contents

1. Introduction	13
2. Guiding Principles	15
3. Polar Bears and People.....	16
4. Species Description.....	17
4.1. Nomenclature.....	17
4.2 Legal Status / Designation in 2012.....	17
4.3 General Description	17
4.4 Biology.....	18
4.4.1 Life cycle and reproduction	18
4.4.2 Natural Mortality and Survival	18
4.4.3 Diet	18
4.4.4 Habitat	19
4.5 Abundance and Distribution	20
4.5.1 Population Delineation and Global Range	20
4.5.2 Range within the Management Plan Area	22
5. Background – Collaborative management of polar bear in the Management Plan Area.....	24
5.1 Recent Management History.....	24
5.2 Land Claims Agreements	25
5.2.1 James Bay and Northern Québec Agreement ⁹	25
5.2.2 Nunavik Inuit Land Claims Agreement ¹⁰	25
5.2.3 Eeyou Marine Region Land Claims Agreement ⁸	25
5.3 Offshore Overlap Agreements.....	25
5.3.1 Reciprocal Arrangements Between Nunavik Inuit and the Inuit of Nunavut ⁷⁸	26
5.3.2 A Consolidated Agreement Relating to the Cree/Inuit Offshore Overlapping Interests Area Between the Crees of Eeyou Istchee and the Nunavik Inuit (The Cree/Inuit Overlap Agreement) ⁷⁹	26
5.3.3 Nunavik Inuit Rights and Interests in the Labrador Inuit Settlement Area Portion of the Overlap Area ⁸⁰	26
5.4 Legislation and Regulations	27
5.4.1 COSEWIC and the Species At Risk Act (S.C. 2002, c. 29)(SARA) ⁸¹	27
5.4.2 <i>An Act Respecting Threatened or Vulnerable Species</i> (chapter E-12.01) (Québec) ⁸⁸	27
5.4.3 <i>An Act Respecting the Conservation and Development of Wildlife</i> (chapter C-61.1) (Québec) ⁹¹	28

5.4.4	An Act Respecting Hunting and Fishing Rights in the James Bay and New Québec Territories (chapter D-13.1) (Québec) ⁹⁰	28
5.4.5	Nunavut Wildlife Act ⁹⁴	29
5.4.6	Wild Animal and Plant Protection and Regulation of International and Interprovincial Trade Act (WAPPRIITA) ¹⁰⁰	29
5.5	Other Polar Bear Management Frameworks	29
5.5.1	1973 Agreement on the Conservation of Polar Bears ¹⁰¹	29
5.5.2	The Federal/Provincial/Territorial Polar Bear Administrative Committee (PBAC) and the Polar Bear Technical Committee (PBTC)	30
6.	<i>Organizations involved in the management of polar bear within Québec, the Eeyou Marine Region and the Nunavik Marine Region: their roles & responsibilities</i>	31
6.1	Organizations whose role applies only in Québec	31
6.1.1	Hunting, Fishing and Trapping Coordinating Committee (HFTCC)	31
6.1.2	Gouvernement du Québec - Ministère des Forêts, de la Faune et des Parcs (MFFP)	31
6.2	Organizations whose role applies to the Marine Regions only	32
6.2.1	Eeyou Marine Region Wildlife Board (EMRWB)	32
6.2.2	Nunavik Marine Region Wildlife Board (NMRWB)	33
6.2.3	Government of Nunavut, Department of Environment	33
6.3	Organizations with roles in Québec and in the Marine Regions.	33
6.3.1	Cree Nation Government (CNG)	33
6.3.2	Local Cree Trappers' Associations (Local CTAs)	33
6.3.3	Regional Cree Trappers' Association (CTA)	34
6.3.4	Local Hunting, Fishing and Trapping Associations (HFTA) / Local Nunavimmi Umajulirijiit Katujjiqatigiinningit (LNUKs)	34
6.3.5	Nunavik Hunting, Fishing and Trapping Association (NHFTA) / Regional Nunavimmi Umajulirijiit Katujjiqatigiinninga (RNUK)	34
6.3.6	Makivik Corporation	34
6.3.7	Government of Canada – Environment and Climate Change Canada (ECCC)	35
7.	<i>Threats to the Conservation of Polar Bears</i>	36
7.1.	General Overview of Conservation Threats	36
7.2	Development	36
7.2.1	Hydroelectric Development	36
7.2.2	Natural Resource and Infrastructure Development	37
7.2.3	Shipping	37
7.2.4	Tourism	38
7.3	Pollution and Contaminants	39
7.4	Parasites and Disease	39
7.5	Climate Change	40
7.6	Unsustainable Harvests	41

8. Management Challenges.....	41
8.1 Research and Monitoring.....	41
8.2 The Human Dimension	43
8.2.1 Harvesting and Harvest Management	43
8.2.2 Changing Communities.....	44
8.2.3 Defence of Life and Property	44
8.2.4 The role of Zoos and Aquariums	45
8.3 Additional Considerations Related to Polar Bear Management.....	46
8.3.1 Subpopulation Boundaries	46
8.3.2 Inter-jurisdictional considerations	46
8.3.3 Legislative Issues	46
8.3.4 International Trade.....	47
9. Management Plan Goal and Objectives	48
Objective 1: Establish a management system based on the best available information, which reflects Inuit and Cree values, and adapt it as necessary to ensure the long-term persistence of polar bears in the management plan area.....	48
Approach 1.1: Review and, as appropriate, renew the 1984 Anguvigaq Polar Bear Regulations and all commitments made therein.	48
Approach 1.2: Base polar bear management decisions upon best available information.	48
Approach 1.3: Revise the harvest registration process with the goal of achieving complete reporting of all human-caused mortality of polar bears.	49
Approach 1.4: Implement a harvest management system that provides the tools necessary to achieve agreed-upon management objectives and long-term persistence of polar bear populations; these can include mechanisms such as NQLs and TAT.	49
Approach 1.5: Annually review all pertinent information to inform adaptive management of polar bears.	52
Approach 1.6: Ensure, as appropriate, the protection of young bears and females.	52
Approach 1.7: Explore the implications and social acceptability of implementing a polar bear sport hunt and, as appropriate, identify the means by which such an activity could be established.	52
Objective 2: Collect Traditional Knowledge and scientific information related to polar bears to inform management decisions.	52
Approach 2.1: Ensure coordination and collaboration towards monitoring the health and abundance of polar bears, at a frequency that allows robust decision-making.	53
Approach 2.2: Document the Traditional Knowledge of Nunavik Inuit and the Crees of Eeyou Istchee to inform research and guide management efforts.	53
Approach 2.3: Improve our understanding of the changes to polar bear habitat, behaviour and interaction with other species and the potential impacts of these changes on polar bears.	53
Approach 2.4: Promote and encourage the training and meaningful involvement of Crees and Inuit in polar bear research and management.	54
Approach 2.5: Work towards improving non-invasive research methods and develop alternative means to collect biological information.	54

Objective 3: Establishing strategies to minimize the effects of human activities on polar bears and their habitat, as well as to reduce human-bear conflicts.	55
Approach 3.1: Document all instances of human-bear conflicts.....	55
Approach 3.2: Develop programs and tools aimed towards reducing human-bear conflicts within the management plan area to increase public safety while reducing the number of Defense of Life and Property kills.	55
Approach 3.3: Clarify the rights and obligations of Inuit, Cree and non-beneficiaries in respect to defense of life and property kills and provide clear guidance on the steps that must be followed when such circumstances arise.	55
Approach 3.4: Promote the respect and ethical treatment of polar bears by all users.	55
Approach 3.5: Minimize the impacts of industrial development, shipping, tourism and other anthropogenic activities on polar bears within the management area.	56
Objective 4: Collaborate, coordinate, communicate and promote the exchange of knowledge and information related to polar bears.	56
Approach 4.1: Foster the transmission of traditional knowledge between elders and youth. .	56
Approach 4.2: Strengthen the two-directional flow of information between community members, researchers, management authorities and other relevant stakeholders.	56
Approach 4.3: Create a permanent forum wherein information and best practices related to polar bears can be discussed, and which will facilitate the coordination of polar bear management by the relevant parties.	57
Approach 4.4: Enhance collaboration with other jurisdictions to guide polar bear management on a national and international level.....	57
 10. Proposed Actions for the Management of Polar Bear in Québec, EMR and NMR	58
 11. References.....	67

1. Introduction

Polar bears play an important role in the culture and livelihoods of Inuit and Cree who inhabit the coastal region of northern Québec. Inuit have used polar bear (*Nanuq* in Inuktitut, *Whabhskewh* in Cree) for food and clothing for millennia; the Cree of Eeyou Istchee have traditionally harvested fewer polar bear than the Inuit, but also place a high value on polar bears as socio-cultural symbols. Accompanying these traditional usages and views have been traditional harvest management practices that largely remain in place to this day.

However, while traditional harvesting practices have existed throughout centuries, the context in which they occur has not. Following the signing of the *1973 Agreement on the Conservation of Polar Bears* by the five polar bear Range States (Canada, United States, Norway, Denmark (Greenland), and Russia), formalized written management regimes were established in most Canadian jurisdictions, with Northern Québec, and adjacent marine areas, being an exception. There has also been increasing international scrutiny of polar bear management and harvesting and international polar bear trade. This has manifested itself in international bans by certain countries and international pressure for stricter control of international trade in polar bear under the Convention on the International Trade in Endangered Species of Wild Fauna and Flora (CITES). In this context, the lack of a formally regulated harvest-management regime in Québec, could be a factor in increased international scrutiny of polar bear management. Any sanctions against the trade of polar bear, including hides, to foreign countries, could deprive Inuit and Cree communities of important sources of income which could in turn negatively impact an important component of their culture – the hunting of polar bears and transformation of their parts for traditional uses.

Partly in response to the above-noted concerns, on January 10, 2012, the then Federal Minister of the Environment requested that the Nunavik Marine Region Wildlife Board (NMRWB) establish a management regime, including a Total Allowable Take (TAT), for the three subpopulations of polar bear that occur in the Nunavik Marine Region (NMR). Given the need for a provincial polar bear management plan (see s.5.4.1), the distribution of polar bears and the jurisdictional complexities of Northern Québec, it was deemed to be desirable and practical to develop a single management plan that could be applicable to both the onshore portion of Québec and adjacent marine regions (the NMR and the Eeyou Marine Region [EMR]). This plan is, therefore, intended to encompass the territories covered under the James Bay and Northern Québec Agreement (JBNQA), the Nunavik Inuit Land Claims Agreement (NILCA) and the Eeyou Marine Region Land Claims Agreement (EMRLCA). The management plan will be approved by the relevant management authorities in accordance with the decision-making mechanisms set out in each of these Agreements and will not be applicable beyond the boundaries defined within them (see Figure 1).

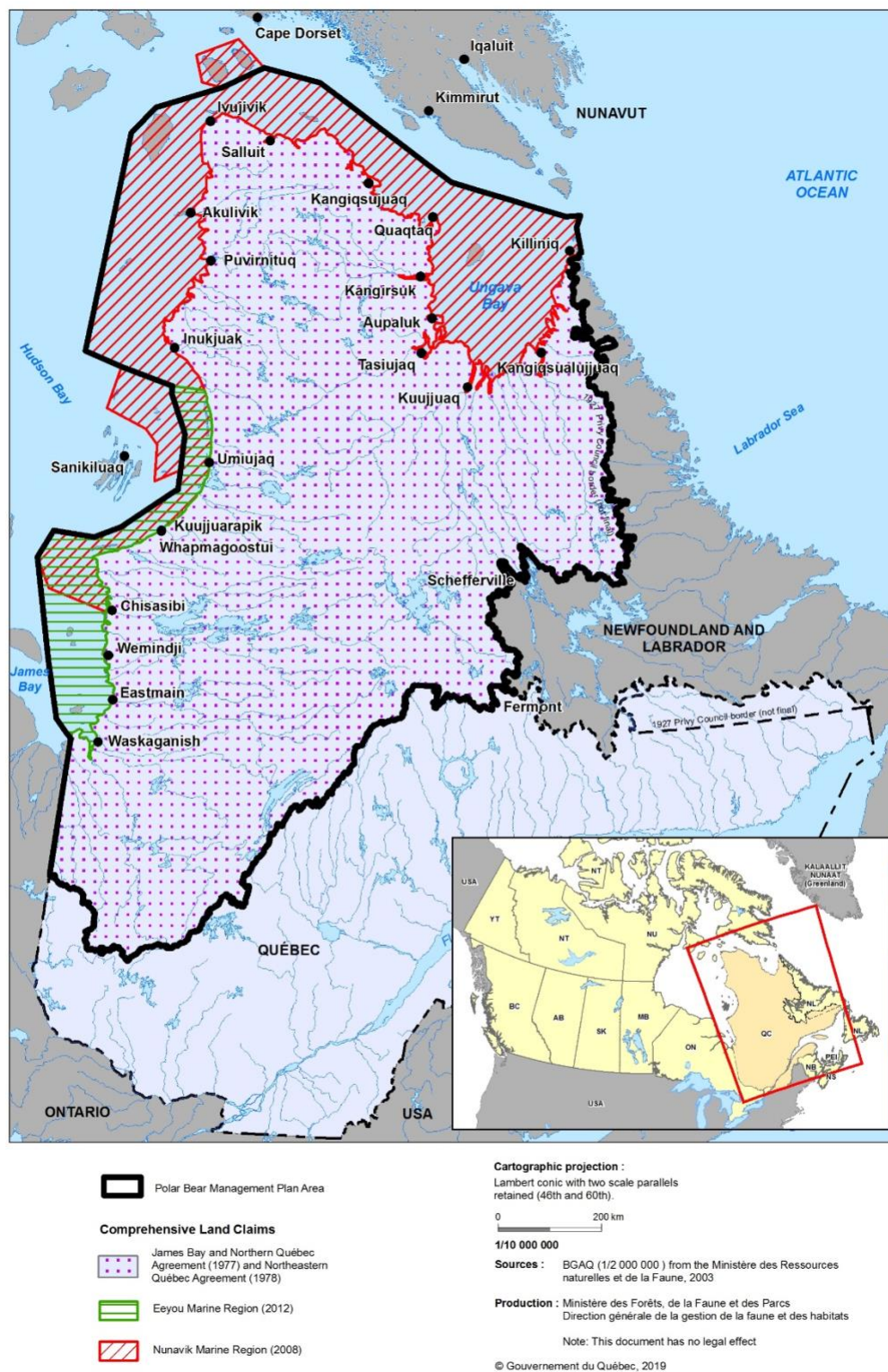


Figure 1. Management Plan Area Based on Relevant Land Claims Agreement Boundaries

2. Guiding Principles

This proposed polar bear management plan is guided by the following principles:

1. The polar bear management plan must recognize and respect the roles, responsibilities and authorities of each organization involved within its area of application (i.e., those areas defined under the Nunavik Inuit Land Claims Agreement (NILCA), the Eeyou Marine Region Land Claims Agreement (EMRLCA) and the James Bay and Northern Québec Agreement ("JBNQA")); collaboration and coordination between these authorities is important for effective polar bear management in Northern Québec.
2. Planning and decision making with regards to the conservation and management of polar bears must be founded upon the best-available Traditional Knowledge (TK) and scientific information; when there is divergence between the two, both perspectives must be considered. Up-to-date information on the status and trends of each polar bear subpopulation is essential for effective management and conservation.
3. The protection of human lives and property is paramount and must be considered when discussing the management and conservation of polar bears.
4. The management plan must be consistent with the wildlife management principles detailed in applicable Land Claims Agreements, including the principles of conservation.
5. Engagement and participation of Nunavik Inuit and the Crees of Eeyou Istchee during the development and implementation of this management plan is important to ensure that their approaches to wildlife management as well as their rights, priorities and concerns are fully considered.
6. Polar bear management in Québec, the Nunavik Marine Region (NMR) and the Eeyou Marine Region (EMR) should be adaptive and able to respond in a timely manner to new information and changing conditions.

The goal of this plan is to maintain healthy polar bear populations which remain an important component of the local ecosystem and which will be available for use by current and future generations in a way that respects and embodies the rights, culture and traditions of the Nunavik Inuit and the Crees of Eeyou Istchee.

3. Polar Bears and People

For millennia, polar bears have played an important role in the lives of the Inuit and Crees of Northern Québec and continue to do so to this day. Whereas Nunavik Inuit have a long history of harvesting polar bears, the Crees of Eeyou Istchee do so only on occasion, usually in defense of life and property, and do not consider themselves polar bear hunters in the same sense as Inuit.

Today, many Inuit continue to eat polar bear, which is generally distributed throughout the community and shared according to traditional values. There is now less reliance on them for clothing, though a number of people, especially elders, continue to make use of the skins for clothing, equipment and crafts. Instead, most of the skins obtained from the polar bear hunt are now sold to southern and international markets. This allows hunters, who may otherwise have limited alternative sources of income, to finance other subsistence hunting activities or simply to purchase supplies and food for their families. Although the economic benefits of polar bear harvesting cannot be overlooked, it is important to recall that the sale of polar bear hides has existed since arrival of the first European fur traders and is not an emerging phenomenon.

The importance of polar bear to Nunavik Inuit, and to the Crees of Eeyou Istchee, goes far beyond food security and economic benefits. It is difficult to quantify the indirect benefits of polar bear to the Nunavik Inuit since they are so closely tied to the hunt itself, but the learning of survival skills and life skills, feelings of fulfillment (especially from sharing the meat) and of pride or accomplishment are all derived from polar bear hunting. For example, the danger of the animal, as well as the skill required to hunt it on the ice make polar bear hunting an efficient and disciplinary way for young hunters to learn invaluable life lessons and traditional skills.

Among the Crees of Eeyou Istchee, most people will recognize a deep cultural importance of the polar bear, and they will share many stories, many of which have to do with the strength of the animal, and how to stay safe in its presence. They also generally recognize the importance that the Inuit attach to the polar bear. The Crees of Eeyou Istchee share with the Nunavik Inuit a growing concern about potential human-bear conflicts, as the bears come on shore and encounter hunting camps and hunters. They therefore also have a common interest in the subject of 'defense of life and property' and the development of appropriate mechanisms both for documenting bear encounters and in minimizing hazards (both for bears and people) associated with those encounters.

Further, polar bears are a part of the psyche of the peoples of Northern Québec. This is demonstrated in people's constant awareness of safety related to living with polar bears, especially when venturing outside of communities. Polar bears have a near-revered status with people often likening them to humans (e.g., referring to polar bears as fellow hunters). In communities that regularly hunt polar bears, harvesting a first polar bear is a coming-of-age experience and an important step in being recognized as a good hunter.

4. Species Description

4.1. Nomenclature

Taxonomic name: *Ursus maritimus* (Phipps 1774)

Inuktitut name: Nanuq, Nanuk

English name: Polar bear

French name: Ours blanc, Ours polaire

Cree name: Whabhskewh, Wâpaskw, Wâpiskw

4.2 Legal Status / Designation in 2022*

International Union for the Conservation of Nature (IUCN): Vulnerable (2015)

Canada (*Species at Risk Act* (S.C. 2002, c.29)): Special Concern (2011)

Québec (*Loi sur les espèces menacées ou vulnérables*): Vulnérable (2009)

Nunavut: Not Assessed

Ontario: Threatened (2009)

Newfoundland and Labrador: Vulnerable (2002)

* This list excludes the legal status / designation given to polar bears by other jurisdictions, which have no direct implication within the management plan area.

4.3 General Description

The polar bear is a top predator characterized by low reproductive rates, long life span, and late sexual maturity. It is a member of the taxonomic family *Ursidae* and is well-adapted to life on the sea-ice and in the water^{13–15}. It is comparable roughly in shape and size to the brown bear (*Ursus arctos*), from which it evolved within the last 400,000 years^{16,17}. However, its neck and nose (rostrum) are more elongated, it has a smaller and less dish-shaped head, and it lacks the characteristic shoulder hump. Its webbed and enlarged front paws make the polar bear a strong swimmer and its curved claws are well-suited for “hooking” seals, their primary food source. Other adaptations to the Arctic environment include furred foot pads and black skin. The black skin assists in absorbing solar energy, whereas the furred pads improve insulation and enhance traction on snow and ice. Polar bear fur appears sometimes white, but it also may be yellowish or off-white, depending on the time of year, and sometimes on the gender. Polar bears exhibit extraordinary strength when crushing through the sea-ice, digging into seal birth and haul-out lairs, or moving large boulders to uncover meat caches. As adults, males are larger and heavier than females: males can weigh around 800 - 1000 kg, and can be up to 300 cm long; females usually do not exceed 400 kg, and reach up to 250 cm in body length^{18–20}.

In general, biologists recognize four important age categories of polar bear: 1) cubs of the year (COYs), 2) yearlings and sub-adults, 3) prime-age adults, and 4) senescent adults. Survival rate also differ between genders with males generally having lower survival rates than females. In the wild, the maximum age a polar bear can attain is estimated at approximately 30 years^{21,22}.

Inuit, on the other hand, recognize several categories/classes of polar bears. 1) Atiqtalik – female on route to sea ice, 2) Pingalujait - a female with two small cubs, 3) Nalitariit - a female with two cubs who are as big as the mother, 4) Avutinikuk - a young bear that has left its mother, 5) Nukaugaq - a young male, 6) Angujjuaq - full grown male, 7) Arnaluq - pregnant female. Although there is some overlap for some of these categories/classes which are general in nature and age-specific, they represent the diverse understanding Inuit have of polar bears.

4.4 Biology

4.4.1 Life cycle and reproduction

Breeding occurs between March and June. When a male mates with a female, ovulation is induced, although implantation of the fertilized egg is delayed until October^{19,23–25}. Depending on the subpopulation, female age at first reproduction varies between 4 and 7 years of age; in most subpopulations, the majority of females produce litters by age 6²⁶. Male polar bears are also likely to become sexually mature by age 6, but younger males generally have low reproductive success because of competition from larger, older males. It appears that most males do not contribute reproductively to the population until they are 8–10 years old^{27–31}.

Pregnant females prepare and enter maternity dens in late fall and the young, normally 1–2, are born between November and early January. At birth, cubs weigh approximately 0.6 kg. They are nursed inside the den until sometime between the end of February and the middle of April. By this time the cubs weigh 10–12 kg²⁸. A new litter is produced after 3 years of raising cubs, so the average interval between litters is approximately 3.6 years.

4.4.2 Natural Mortality and Survival

For polar bears, natural mortality can occur from numerous causes. Polar bears have been observed and documented to pose a threat to other polar bears^{32–34}. Predation by wolves on polar bear cubs have been observed by Inuit and researchers³⁵. Walruses have also been reported to kill polar bears in self-defence, but this is infrequent. Every life stage of a polar bear faces different challenges; therefore, the survival rates vary accordingly. Moreover, the survival rates for these life stages also vary slightly in each polar bear subpopulation because of the differences in ecosystem productivity.

4.4.3 Diet

Although polar bear diet varies throughout the year and across its range, they are highly carnivorous with ringed, bearded and harp seals making up most of their diet. Polar bears are also known to frequently include birds (and their eggs) and beluga whale in their diet. Other species such as walrus, narwhal, bowhead whale, arctic char, beaver, caribou, and harbour seal may also be preyed upon^{36–38}. Nunavik Inuit report that, after spending extended periods at sea, bears returning to land eat large amounts of vegetation as a means of preparing their body for life on land. Elders report that a similar behaviour is observed in females preparing to enter maternity dens, and it is believed that their intake of moss and lichen allows them to better retain and absorb the oils contained in the seals that they have previously eaten³⁹.

Polar bears are well-adapted to times of food abundance and shortages. When food is in high abundance, polar bears can increase their body mass significantly. When food becomes scarce or unavailable, polar bears can live off their stored fat reserves^{28,40}. While polar bears will hunt and scavenge throughout the year, feeding opportunistically on almost anything they can find, spring represent a crucial feeding period. As seal pups are born and become abundant, polar bears enter a period of high food intake where they will accumulate most of the fat needed to survive through the summer and fall seasons, when food resources are harder to access. In seasonally ice-free areas where bears move on shore, vegetation, berries, eggs, birds, and other terrestrial or marine-based food items are consumed^{41–50}. Although the behaviour is not thoroughly documented, Cree and Inuit hunters report that fish and ringed seals are successfully preyed upon during summer, when there is little or no sea-ice^{50,51}. Inuit from Kangiqsualujjuaq report that bears have recently developed the behavior of catching arctic char from rivers in a manner similar to that of brown bears catching spawning salmon³⁸. Marine mammal ice-entrapment events and Inuit marine mammal harvesting can also create an additional food source which polar bears access by scavenging.

One aspect to take into consideration when discussing foraging opportunities for polar bear in relation to Inuit subsistence harvesting practices is that Nunavik Inuit have resumed the tradition of harvesting bowhead whales and although the number of hunts has been limited, they remain interested in doing so. The importance of bowhead carcasses to polar bear diets has been demonstrated in other regions, but can also lead to a greater risk of human-bear encounters⁵². The regulatory framework surrounding Nunavik's annual beluga hunt has, similarly, led to a change in the distribution and abundance of beluga carcasses. It is not known to what extent these supplementary food sources have impacted polar bear foraging habits.

4.4.4 Habitat

Polar bears utilize the marine environment for hunting marine animals, primarily when there is some degree of ice-cover. Polar bears have adapted to all different types of sea ice and are strong swimmers, capable of traveling long distances in open water. Inuit have indicated that bears can persist in open water and sea ice for the majority of their lives (the Inuktitut term for this is *Tulayuituq*). Inuit also recognize that different areas of the sea-ice habitat can be particularly important for separate aspects of polar bear life history (e.g. breeding areas, resting areas, feeding areas, etc.)^{38,53}.

Polar bears utilize most coastal areas of the Canadian subarctic and Arctic and occasionally travel considerable distances inland. In areas where there is only seasonal sea-ice, access to land is usually required for ice-free periods and for denning in winter. Although some denning does occur in packed snow drifts that have built up over pressure ridges in winter sea-ice, within the management area, polar bears den primarily on land. Dens are generally excavated in soil or snow and are then covered and closed by snowdrifts. While they are frequently located on islands or on land adjacent to areas with high seal densities in spring, dens can sometimes be found far inland from the coast or in areas of annual rough ice. Nunavik Inuit have also observed bears denning in snow buildups around hills and mountains, as well as using excavated dens south of the tree line³⁸. All maternity denning sites are important areas because they provide shelter for the mother and offspring^{53,54,63–66,55–62}. Satellite telemetry data from female collared polar bears indicate that they often return to the same area to den over the course of their lifetime.

4.5 Abundance and Distribution

4.5.1 Population Delineation and Global Range

There is an estimated world population of approximately 26,000 polar bears (95% CI = 22,000-31,000) occurring throughout the sub-arctic and Arctic regions of the northern hemisphere⁶⁷. This estimate excludes any bears from the Arctic Basin subpopulation for which no information on abundance is available. Polar bears are highly mobile and there is significant genetic exchange across the circumpolar region. However, they are not distributed evenly throughout the Arctic, but rather show seasonal fidelity to local areas based, to some extent on their use of sea-ice as a platform for feeding, mating, and denning^{68–70}, but also by the availability and quality of sea-ice^{71–76}. Given this, the global population has been divided into 19 “subpopulations”⁷⁷; 13 of which exist in Canada²⁶, and three within the area represented by this management plan (Figure 2; see section 4.5.2, below).

For each of the three polar bear subpopulations that occur within the management plan area, information about its abundance, health and observed trends is included in the appendices that accompany the management plan. This information includes an overview of historical data and the most-recent information available for each subpopulation. Because polar bear research is ongoing and since abundance estimates are updated regularly, likely multiple times within the lifespan of this management plan, it is more appropriate to include this information in the appendices, which can be updated as new information becomes available.

The geographic boundaries of subpopulations that have become the basis for polar bear management in Canada were initially established by the Polar Bear Technical Committee (PBTC) (see section 5.5.2, below) and have since been updated based on the movements of satellite radio-collared female polar bears, mark-recapture efforts (including hunter returns of ear tags or samples from marked bears), and according to the hunting practices and information of local people^{68,69}. However, the premise of identifying subpopulation boundaries continues to be disputed by Inuit, who maintain that polar bears do not stay within these boundaries and instead travel wherever they so choose. It is therefore important to specify that the geographic boundaries of subpopulations, although based on extensive information do not necessarily reflect ecologically meaningful separations. Rather, they are artificial boundaries used within a management context to track local trends in the polar bear population, to observe any changes in demographic parameters and behaviour as well as to conduct harvest monitoring. Doing so helps ensure that polar bear management is more practicable and better adapted to local conditions.

Subpopulation boundaries...are artificial boundaries used within a management context to track local trends in the polar bear population, to observe any changes in demographic parameters and behaviour as well as to conduct harvest monitoring. Doing so helps ensure that polar bear management is more practicable and better adapted to local conditions.

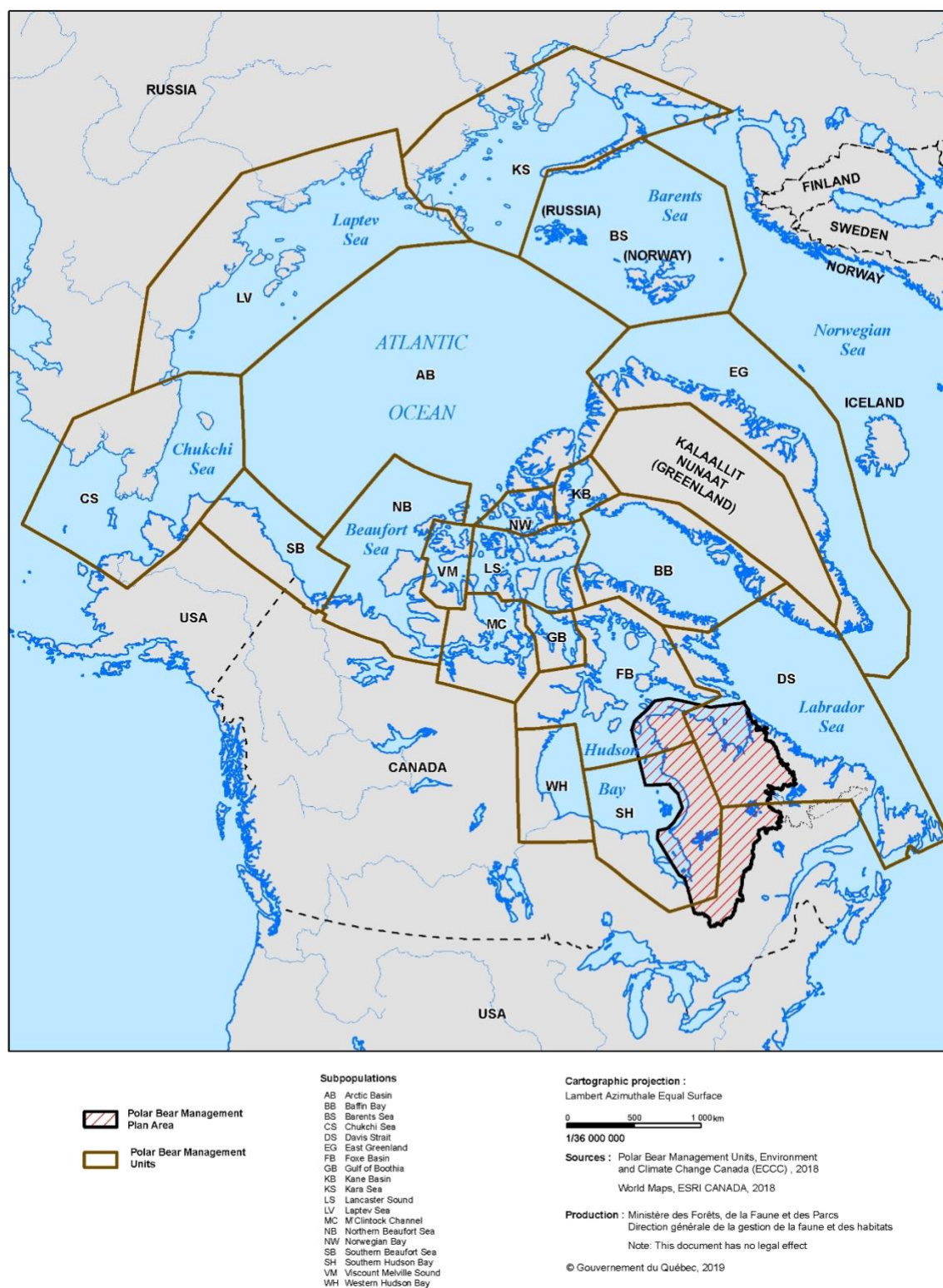


Figure 2. Global distribution of polar bear subpopulations

4.5.2 Range within the Management Plan Area

Three of Canada's polar bear subpopulations (Southern Hudson Bay, Foxe Basin and Davis Strait) occur in Northern Québec and its adjacent waters (Figure 3). These are among the southernmost subpopulations in the world and all of them experience a seasonally ice-free environment, which forces the bears onto shore during late summer, where they remain for several months while awaiting freeze-up. The distribution of each subpopulation within the management plan area is described below and in Figure 2:

- The Southern Hudson Bay subpopulation includes all of the area of James Bay and the Hudson Bay south of the 60th parallel, and is shared by Québec, Ontario and Nunavut.
- The Foxe Basin subpopulation occupies the northern part of Hudson Bay and the Hudson Strait, until a point west of the village of Kangiqsujuaq, and is shared by Québec and Nunavut.
- The Davis Strait subpopulation occupies the remaining portion of Hudson Strait and all of Ungava Bay, and is shared by Québec, Nunavut, Newfoundland & Labrador, and Greenland. Because the Davis Strait region was not traditionally referred to as such by Inuit, there is no equivalent terminology in Inuktitut. Consequently, Inuit have suggested that referring to this subpopulation as the "Killiniq-waters subpopulation" is more appropriate.

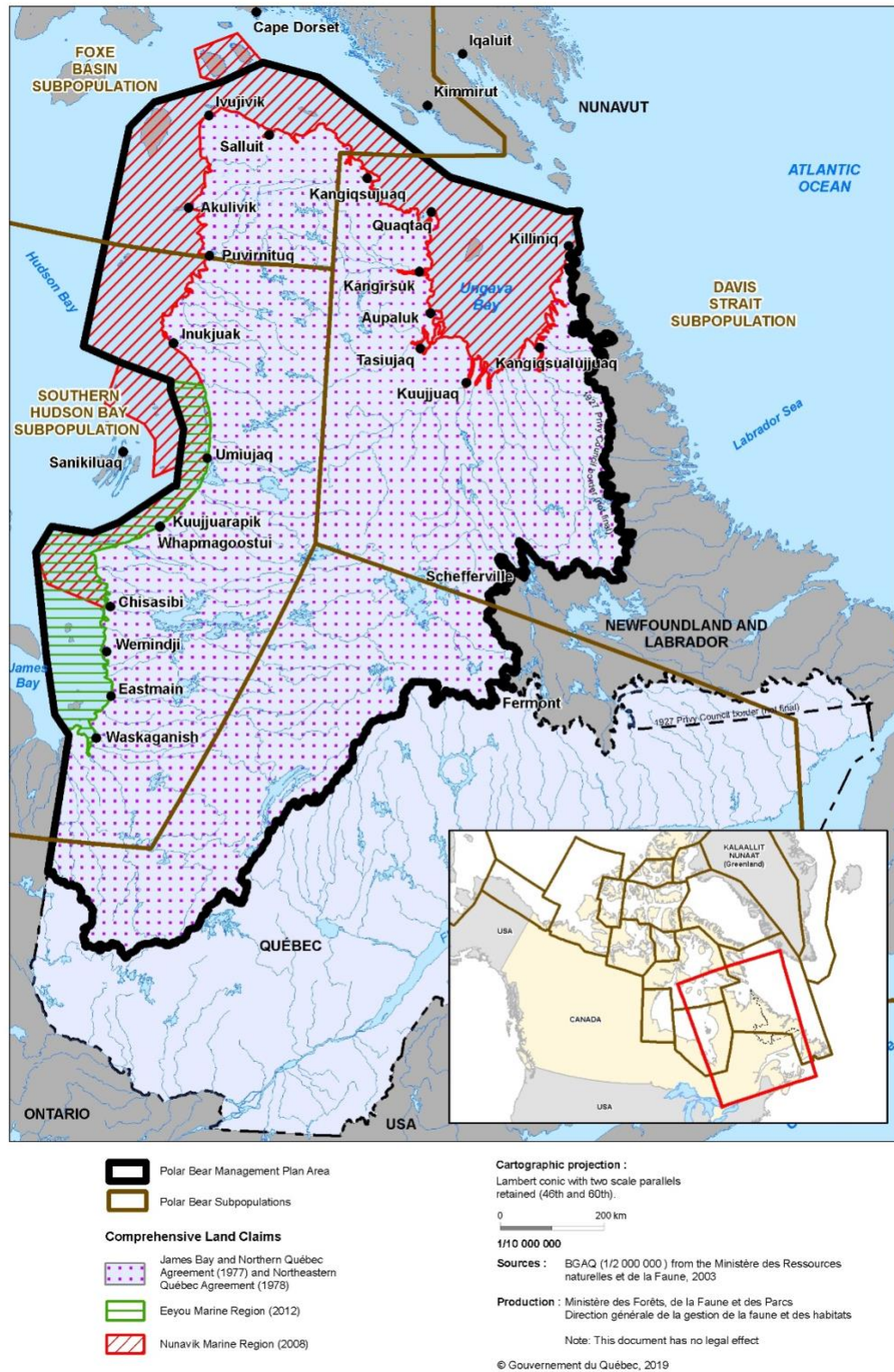


Figure 3. Polar Bear Subpopulations in the management plan area

5. Background – Collaborative management of polar bear in the Management Plan Area

The following section describes the elements that should be considered for the management of polar bears within the management area. While only modern management initiatives and frameworks are defined here, it is important to recognize that Inuit and Cree hunters have shared this region with polar bears for millennia. Throughout this time, they have developed a formal code of conduct, which puts forth a set of rules that govern all interactions with polar bear. Despite the advent of modern management practices and regulations, hunters in the region continue to rely strongly on their traditional values and rules.

5.1 Recent Management History

The following chronology highlights significant initiatives related to the conservation and management of polar bears since 1973. It is not inclusive of all work undertaken and in particular does not include specific LNUK initiatives or other similar community-based efforts.

- 1973: Agreement on the Conservation of Polar Bears (the Range State Agreement)
- 1975: Convention on the International Trade in Endangered Species of Wild Fauna and Flora Appendix II listing; at this time, CITES is implemented in Canada through regulations under the *Export and Import Permits Act* (EIPA), which includes polar bear on its list of species controlled
- 1975: James Bay and Northern Québec Agreement
- 1984: Nunavik Hunters, Fishermen & Trappers Association (*Anguvigaq*) Polar Bear Regulations
- 1996: Wild Animal and Plant Protection and Regulation of International and Interprovincial Trade Action proclaimed and EIPA regulations repealed; polar bear included in Schedule I of the Wild Animal and Plant Trade Regulations
- 2008: Nunavik Inuit Land Claims Agreement
- 2009: Listed as a vulnerable species under the Québec Act Respecting Threatened or Vulnerable Species listing
- 2010: Davis Strait User to User Meeting
- 2011: Southern Hudson Bay Polar Bear Voluntary Agreement on, inter alia, allocation of harvest*
- 2011: Federal Species at Risk Act Listed Polar Bear as a species of special concern
- 2012: Eeyou Marine Region Land Claims Agreement
- 2014: Nunavik Marine Region Wildlife Board Southern Hudson Bay Polar Bear Public Hearing (2014)
- 2014: Southern Hudson Bay Polar Bear Voluntary Agreement on, inter alia, allocation of harvest**
- 2015: 2nd Davis Strait Polar Bear User to User Meeting
- 2016: TAT established for Southern Hudson Bay within Nunavik Marine Region
- 2018: COSEWIC Assessment of Polar Bears - *Special Concern*
- 2020: Southern Hudson Bay Polar Bear User to User Meeting

* The 2011 Voluntary agreement was for one year (i.e., 2012), and was later extended for a second year (2013)

** The 2014 Voluntary Agreement was for a period of two hunting seasons (2014-2016).

5.2 Land Claims Agreements

The following section is intended to provide a brief description of the various Land Claim Agreements applicable to the area covered by the management plan. For additional context regarding the framework for polar bear management established by each Land Claim Agreement, it is necessary to refer to the official text of each agreement.

5.2.1 James Bay and Northern Québec Agreement⁹

The JBNQA, signed principally between the Crees of Eeyou Istchee, the Nunavik Inuit and the Governments of Québec and Canada, is widely recognized as the first comprehensive land claim agreement in Canada and came into force in 1977. The JBNQA establishes a special hunting, fishing and trapping regime. Under this regime, the polar bear is a species reserved exclusively for the Native people (persons who are eligible under Sections 3 and 3A of the JBNQA). The exercise of the right to harvest is subject to the principle of conservation as established in the JBNQA. The JBNQA provides for the establishment of guaranteed levels of harvest to the Native people before any other type of harvest can be carried out. The JBNQA applies to Quebec territory as defined in article 1.16 of the JBNQA, while the hunting, fishing and trapping regime applies to the territory defined in article 24.12 of this agreement. The JBNQA also establishes the constitution and responsibilities of the Hunting, Fishing and Trapping Coordinating Committee (see section 6.1.1). The JBNQA was approved, given effect and declared valid by the *Act approving the James Bay and Northern Quebec Agreement* (chapter C-67).

5.2.2 Nunavik Inuit Land Claims Agreement¹⁰

The Nunavik Inuit Land Claims Agreement (NILCA) came into force in 2008 and establishes rights for Inuit in the Nunavik Marine Region (NMR), namely the islands and waters offshore of Nunavik. The NILCA is an Agreement between the Inuit of Nunavik, the Government of Canada and the Nunavut Government. Established pursuant to Article 5 of the NILCA, the Nunavik Marine Region Wildlife Board (NMRWB) makes decisions on wildlife management issues in the NMR, including polar bear management. The NILCA (s. 5.3.7 c)) establishes a presumption that Nunavik Inuit need the total allowable take of polar bear. The relevant federal or territorial (Nunavut) Ministers (in the case of polar bear, the Minister of Environment and Climate Change and the Minister of Environment, respectively) maintain ultimate authority.

5.2.3 Eeyou Marine Region Land Claims Agreement⁸

The Eeyou Marine Region Land Claims Agreement (EMRLCA) came into force in 2012, and establishes the rights of Crees in the Eeyou Marine Region (EMR), namely the islands and waters of eastern James Bay and a portion of eastern Hudson Bay. The EMRLCA is an Agreement between the Crees of Eeyou Istchee, the Government of Canada and the Nunavut Government. The EMRLCA (par. 11.3.1 and Schedule 11-1) establish that polar bear is a wildlife species exclusively reserved for the use of the Crees of Eeyou Istchee. Established pursuant to Chapter 13 of the EMRLCA, the Eeyou Marine Region Wildlife Board (EMRWB) makes decisions on wildlife management issues in the EMR, including polar bear management. The relevant federal or territorial (Nunavut) Ministers (in the case of polar bear, the Minister of Environment and Climate Change and the Minister of Environment, respectively) maintain ultimate authority.

5.3 Offshore Overlap Agreements

Harvesting activities by Cree and Inuit were not historically constrained by the jurisdictional boundaries that exist today. Certain areas were traditionally used and occupied by more than one group. The NMR, the EMR, the Nunavut Settlement Area and the Labrador Settlement Area (LSA) provide for reciprocal rights in these overlapping areas that are protected by Section 35 of the *Constitution Act, 1982*. These

reciprocal arrangements form an integral part of each of the offshore Land Claims Agreements. Three such overlap agreements, between the relevant parties, apply within the geographic area addressed within this management plan and are presented in this section.

5.3.1 Reciprocal Arrangements Between Nunavik Inuit and the Inuit of Nunavut⁷⁸

Two areas within the NMR are shared by Nunavut and Nunavik Inuit; these are referred to as Areas of Equal Use and Occupancy (AEUO). The first is at Nottingham and Salisbury Islands and is within the range of Foxe Basin polar bears. The second is within the Southern Hudson Bay subpopulation area and includes a number of islands situated between the communities of Umiujaq, QC and Sanikiluaq, NU. Within these AEUO, Inuit from Nunavik and Nunavut have equal harvesting rights. Until a formal process to govern wildlife management within the AEUO is established, the Nunavut Wildlife Management Board retains exclusive jurisdiction over this area, but the NWMB's membership is varied to allow for Nunavik Inuit representation through the appointment of members by Makivik (see NILCA Part 27.6).

5.3.2 A Consolidated Agreement Relating to the Cree/Inuit Offshore Overlapping Interests Area Between the Crees of Eeyou Istchee and the Nunavik Inuit (The Cree/Inuit Overlap Agreement)⁷⁹

Similarly, the Crees and Inuit traditionally used and occupied overlapping areas in Southern Hudson Bay and James Bay. Because traditional ties to these areas were not uniform, three separate overlap areas were created (i.e., the Inuit Zone, the Joint Zone and the Cree Zone) to reflect the latitudinal gradient of occupancy by each group. Throughout the overlap area, the Nunavik Inuit and the Crees of Eeyou Istchee have the same rights respecting the harvest of wildlife; these rights being exercised in accordance with each group's respective customs and traditions, in a manner so as not to compromise each other's harvesting activities.

Although harvesting rights are equal within all zones, the management regime applicable to each is not. For the Inuit Zone, the NMRWB maintains wildlife management responsibilities, but a Cree Nation Government observer is entitled to replace a Makivik appointed board member during any vote. For the Joint Zone, wildlife management decisions are to be made jointly and equally by the NMRWB and EMRWB. Within the Cree Zone, the EMRWB maintains wildlife management responsibilities, but a Makivik appointed observer is entitled to replace a Cree board member during any vote.

5.3.3 Nunavik Inuit Rights and Interests in the Labrador Inuit Settlement Area Portion of the Overlap Area⁸⁰

The last overlap area included within this management plan's area of application is situated along the Québec/Labrador border and into the adjacent offshore areas. Pursuant to this agreement, Nunavik Inuit and Labrador Inuit have equal harvesting rights within the area of overlap. Although Labrador Inuit and Nunavik Inuit may share the right to harvest, their combined take shall not exceed the total allowable take (TAT) in either region and is subject to any other obligations in effect. As such, the bodies responsible for wildlife management in the NMR (NMRWB) and in the LSA (Torngat Secretariat) must take into account each other's current and historic harvesting levels, as well as those of other groups (e.g., Nunavut Inuit) when setting harvest limits.

5.4 Legislation and Regulations

5.4.1 COSEWIC and the Species At Risk Act (S.C. 2002, c. 29)(SARA)⁸¹

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC)⁸², established in 1977, is the independent body responsible for identifying and assessing the status of species considered to be at risk in Canada. COSEWIC uses best available information, including science, Aboriginal Traditional Knowledge and community knowledge. Membership consists of members from each of the 13 provincial and territorial government wildlife agencies, 4 federal agencies (Canadian Wildlife Service of Environment and Climate Change Canada, Parks Canada Agency, Department of Fisheries and Oceans, and the Canadian Museum of Nature), 3 non-government science members, 10 Co-chairs of the Species Specialist Subcommittees and 1 Co-chair from the Aboriginal Traditional Knowledge (ATK) Subcommittee. The assessments made by COSEWIC are forwarded to Canada's Minister of Environment and Climate Change and to the Canadian Endangered Species Conservation Council. The Governor in Council (Cabinet), on the recommendation of the Minister of Environment and Climate Change, decides whether or not to add the species to the federal List of Wildlife Species at Risk, or refer the matter back to COSEWIC. In other words, if COSEWIC classifies a species as *Endangered* it does not automatically become a Species at Risk under SARA. As a legislated requirement, COSEWIC reviews species assessments at least every 10 years, or earlier if new information suggests a change in status may be warranted.

In 1986⁸³, after the first COSEWIC assessment, it was determined that polar bears were *Not at Risk*. This was changed to a designation of *Special Concern* in 1991⁸⁴, a status which was confirmed by assessments conducted in 1999⁸⁵, 2002⁸⁶, and 2008⁸⁷. Following the 2008 assessment, public consultations were held to inform the possible listing of polar bear as a species of Special Concern under SARA. These consultations were completed in 2011.

Despite disagreement from most Inuit, the polar bear was listed federally as a species of Special Concern under SARA in 2011. The listing requires the identification of conservation measures for the species; however, it does not impose any restrictions on the harvest, nor does it require the identification and protection of critical habitat. However, under SARA, (ECCC) is responsible for the preparation of a management plan and is required to report on progress every subsequent five-year period after the publication of the final document on the SAR public Registry, until the objectives are achieved. Once the present plan is finalized, it is expected that it will be incorporated, in part, or in whole, within the SARA Management Plan. The SARA Management Plan will also include other provincial and territorial management plans.

5.4.2 *An Act Respecting Threatened or Vulnerable Species* (chapter E-12.01) (Québec)⁸⁸

The objective of this Act is to protect biological diversity and to prevent the extinction of wildlife and plant species in Québec. It is meant to prevent the decline of previously listed species and to ensure the protection of their habitats, as well as to prevent any other species from becoming threatened or vulnerable. In accordance with the *Regulation respecting threatened or vulnerable wildlife species and their habitats*, the Gouvernement du Québec listed the polar bear as a vulnerable species in 2009⁸⁹.

Established under article 6 of this Act, the 1992 Québec Species at Risk Policy stipulates that a vulnerable species is one whose survival is at risk even if its disappearance is not foreseen. This category includes species whose medium and long-term survival is not guaranteed. Downward population trends or habitat degradation may occur if no action is taken to ensure the species survives.

Identification of prohibited activities for listed species must take into account the level of risk they face. In the case of vulnerable species, their survival is not threatened in the short or medium term but could become threatened if no measures are taken to reverse the factors affecting them. Therefore, certain species, particularly if listed as vulnerable, are able to undergo some level of exploitation if it can be demonstrated that such activities in no way harm the current state of affairs and if all possible measures are taken to restore balance.

In Northern Québec, provisions dealing with threatened or endangered species (e.g. polar bear) are also subject to the terms of the *Act Respecting Hunting and Fishing Rights in the James Bay and New Québec Territories*⁹⁰ (see section 5.4.4, below).

5.4.3 An Act Respecting the Conservation and Development of Wildlife (chapter C-61.1) (Québec)⁹¹

The objective of this Act is the conservation of wildlife and its habitat, their development in keeping with the principle of sustainable development, and the recognition of every person's right to hunt, fish and trap in accordance with the law. To that end, this Act establishes various prohibitions that relate to the conservation of wildlife resources and various standards of safety, and sets forth the rights and obligations of hunters, fishers and trappers. According to this Act, the hunting and trapping of animals is prohibited. However, the Minister may, by regulation, allow the hunting and trapping of any animal or any animal of a class of animals determined by the Minister. Under this Act's *Regulation respecting trapping activities and the fur trade*⁹², in order to have in one's possession or to export outside Québec a raw polar bear pelt from Québec, a person needs to have a tag provided by the MFFP attached to the pelt. Under this Act's *Regulation respecting animals that must be declared*⁹³, wounded or dead polar bears must be reported to a wildlife protection officer and given to them if required. The Crees and Inuit of Québec may, however, own the proceeds of their right to harvest under the *Act Respecting Hunting and Fishing Rights in the James Bay and New Québec Territories*⁹⁰ and are therefore exempt from the obligation to affix a tag in order to be able to possess an undressed pelt of a polar bear, as well as the obligation to declare bears dead. However, they must report their catches and affix a tag on polar bear skins in order to be able to sell them to a non-beneficiary of the JBNQA or export them outside Québec. Sport hunting of polar bears is prohibited as harvesting is reserved exclusively to the beneficiaries of the James Bay and Northern Québec Agreement pursuant to the *Act Respecting Hunting and Fishing Rights in the James Bay and New Québec Territories*⁹⁰. Where any provision of the *Act Respecting the Conservation and Development of Wildlife*⁹¹ is incompatible with any provision of the *Act Respecting Hunting and Fishing Rights in the James Bay and New Québec Territories*⁹⁰, the latter prevails.

5.4.4 An Act Respecting Hunting and Fishing Rights in the James Bay and New Québec Territories (chapter D-13.1) (Québec)⁹⁰

The *Act Respecting Hunting and Fishing Rights in the James Bay and New Québec Territories*⁹⁰ notably implements Section 24 of the James Bay and Northern Québec Agreement. The Hunting, Fishing and Trapping Regime established by this Act is subject to the principle of conservation, as defined in the JBNQA and previously in this document. According to this Act, polar bear is, on the territory of application of the regime, reserved for the exclusive use of JBNQA beneficiaries who may exercise their right to harvest throughout the year. This Act provides for the process of determining and revising guaranteed harvest levels, which were established by agreement between the parties at 58 bears for Inuit in 1985 and 4 bears for Cree in 1989.

5.4.5 Nunavut Wildlife Act⁹⁴

On July 1, 2015, several new wildlife regulations^{95–97} and orders under the Nunavut Wildlife Act came into effect within the Nunavut Settlement Area (NSA). At the time of writing, the Wildlife Transitional Regulations⁹⁸ remain in effect within the NMR and EMR. Pursuant to these transitional regulations, only regulations that were previously enforced through the Northwest Territories *Wildlife Act*⁹⁹ are currently enforceable within the NMR and EMR lands, the new wildlife regulations and orders not having been adopted outside of the NSA. This section will be amended once a permanent arrangement has been made with regards to the application of the Nunavut Wildlife Act and its regulations within the NMR and EMR.

5.4.6 Wild Animal and Plant Protection and Regulation of International and Interprovincial Trade Act (WAPPRIITA)¹⁰⁰

Canada meets its obligations under the CITES through WAPPRIITA. This Act regulates import, export and interprovincial transport of certain species of wildlife and their parts and derivatives. It applies to:

- species listed under the Appendices of CITES;
- foreign species that were taken, possessed, distributed or transported in contravention of the law of a foreign state;
- Canadian species whose transportation is regulated by provincial or territorial laws;
- species whose introduction into Canada could be harmful to Canadian ecosystems.

Polar bear is listed on Appendix II of CITES. Appendix II species are not necessarily threatened with extinction but for which trade must be controlled to avoid a detriment to the survival of the species in the wild. CITES export permits are required for international trade and certain requirements must be met before an export permit can be issued. This includes an evaluation of whether the specimen being traded has been legally harvested, and whether the trade of the specimen is not detrimental to the species (a “non-detriment finding” or NDF).

5.5 Other Polar Bear Management Frameworks

5.5.1 1973 Agreement on the Conservation of Polar Bears¹⁰¹

The need for an international convention or agreement for polar bear conservation was originally recognized and pursued in the mid-1960s. Increased hunting of polar bears had led to severe pressure on the species in some regions of the Arctic. The Arctic Range States (Canada, Denmark (Greenland), Norway, the Union of Soviet Socialist Republics [U.S.S.R., now Russia] and the United States) recognized the need for improved management of polar bears based on scientific knowledge. The *Agreement on the Conservation of Polar Bears*¹⁰¹ (the 1973 Agreement) was signed in Oslo on November 15, 1973, and entered into force on May 26, 1976. According to the 1973 Agreement, the Range States recognize that the polar bear is a significant resource of the Arctic Region that requires protection. By signing the Agreement, the Range States agreed to take appropriate action to protect the ecosystems of which polar bears are a part, with special attention to habitat components such as denning and feeding sites and migration patterns, and to manage polar bear populations in accordance with sound conservation practices based on the best available scientific data.

At the time the 1973 Agreement was signed, the most significant threat facing the polar bear was overharvesting, and populations in some areas were considered to be substantially reduced. However, over 45 years have since passed, harvest control measures have been implemented, and harvest is no longer considered to be the most significant threat to the species.

In 2009, the Range States started to develop a Circumpolar Action Plan (CAP)¹⁰² to address seven key threats, climate change being the over-arching, long-term and most significant threat facing the polar bear. The CAP, approved by the Range States in 2015, is a range-wide strategy designed to guide the mitigation of those threats. It recognizes that there are already effective management systems in place in each Range State, and therefore focuses on issues that are best coordinated at the bilateral or multilateral level. The CAP identifies general actions to be undertaken over the next ten years (2015-2025) and is accompanied by a more detailed implementation plan for the first two years. Progress will be reviewed every two years by the Range States at their Meetings of the Parties and the implementation plan will be updated accordingly. Progress reports and action tables will be made public.

5.5.2 The Federal/Provincial/Territorial Polar Bear Administrative Committee (PBAC) and the Polar Bear Technical Committee (PBTC)

Canada's commitment to a cooperative approach to polar bear research and management began almost 45 years ago with the establishment of the PBAC and the PBTC. The PBAC provides a forum for provincial, territorial and federal jurisdictions to work together to manage polar bears, and to ensure that Canada fulfills its obligations to the 1973 *Agreement on the Conservation of Polar Bears*. In this capacity, the PBAC plays a key role in national coordination and cooperation within and between jurisdictions. The PBTC is composed of experts from Canadian jurisdictions and co-management partners, in both TK and science, who review and evaluate new information in order to provide status and trend updates annually, and to advise the PBAC on technical matters.

6. Organizations involved in the management of polar bear within Québec, the Eeyou Marine Region and the Nunavik Marine Region: their roles & responsibilities

Management efforts are shared in accordance with the roles and responsibilities of the various stakeholders and governmental organizations involved. Although the parties involved in the development of this management plan have varying levels of management authority and, though the scope of their involvement is not uniform, the sum of their parts is essential to the implementation of an effective polar bear management plan. From the involvement of hunters whose constitutional harvesting rights stand to be affected by any future regulations, to governments who are the ultimate authorities responsible for the implementation and enforcement of any conservation and management measures that will arise from this process, this has been a collaborative effort throughout. Polar bear management in the management plan area falls under the legislative authority of various entities and involves multiple stakeholders. In order to provide some clarity about the processes at play, the following section provides an overview of the role that each organization plays with regards to the planning, approval and implementation of the Québec-EMR-NMR Polar Bear Management Plan.

6.1 Organizations whose role applies only in Québec

6.1.1 Hunting, Fishing and Trapping Coordinating Committee (HFTCC)

The HFTCC is the preferential and exclusive forum for Native people and governments to jointly formulate regulations and supervise the administration and management of the hunting, fishing and trapping regime established under Section 24 of the JBNQA. The HFTCC can also initiate, discuss, review and propose to the responsible Provincial or Federal minister regulations or other measures relating to the regulation, supervision and management of the hunting, fishing and trapping regime.

In addition, subject to certain provisions, the responsible minister shall consult with the HFTCC before submitting a new regulation or other decision for enactment or taking new action and before modifying or refusing to submit for enactment draft regulations or other decisions from the HFTCC. He shall endeavor to respect the views and positions of the HFTCC on any matter respecting the hunting, fishing and trapping regime. When the HFTCC or the responsible government decides that regulations are necessary, the responsible government shall make regulations with a minimum of impact on the beneficiaries of the JBNQA and harvesting.

The HFTCC members are appointed as follows: the Gouvernement du Québec appoints 4 members, Government of Canada appoints 4 members, the Inuit (Makivik Corporation) appoint 3 members, the Crees (Cree Nation Government) appoint 3 members and the Naskapi (Naskapi Nation of Kawawachikamach) appoint 2 members.

6.1.2 Gouvernement du Québec - Ministère des Forêts, de la Faune et des Parcs (MFFP)

The Ministère des Forêts, de la Faune et des Parcs is the authority responsible for the management of wildlife within Québec (under the authority of MFFP Minister) and therefore participates in interjurisdictional processes related to polar bear management. In the Québec territory covered by the JBNQA, polar bear management must be carried out in accordance with Section 24 of the JBNQA.

The MFFP shares, with neighbouring authorities, responsibility for monitoring the abundance and trends of the three polar bear subpopulations present in Québec and in adjacent waters. The MFFP is also

responsible for compiling and analyzing harvest data. Currently, the monitoring of polar bear harvest is implemented by the MFFP at the community level through a collaboration with representatives of the Kativik Regional Government's Hunter Support Program in each of the 14 Inuit communities and with the Cree Trappers Association for the five coastal Eeyou Istchee Cree communities. At the time of publishing this management plan, in Québec, the Inuit and the Crees are not required to register their polar bear harvest (except for portions of the range of the South Hudson Bay subpopulation). They do so on a voluntary basis and the harvest data obtained to date by the MFFP is therefore incomplete.

Under the *Act Respecting the Conservation and Development of Wildlife*⁹⁰, the possession of a raw polar bear pelt is subject to specific rules in Québec. The MFFP is responsible for the distribution of tags which are mandatory for any non-Native person having a raw polar bear hide in his possession as well as to export hides outside of Québec. The MFFP is also responsible for issuing export permits for interprovincial trade (these are also necessary to obtain international export permits).

The wildlife protection division of MFFP is responsible for enforcement and investigations concerning the registration and the trade of polar bear pelts within its jurisdiction in collaboration with Environment and Climate Change Canada. Wildlife protection officers are also involved in the promotion of wildlife conservation and have developed education and awareness initiatives for this purpose. MFFP has posted protection officers in some Cree and Inuit communities to fulfill the above-noted roles. In addition, wildlife protection assistants (Uumajuit wardens) are appointed in most Nunavik communities, through a collaboration between the MFFP and the Kativik Regional Government, to assist wildlife protection officers in the performance of their duties.

6.2 Organizations whose role applies to the Marine Regions only

6.2.1 Eeyou Marine Region Wildlife Board (EMRWB)

The EMRWB is an 'institution of public government' and an independent co-management body established under the EMRLCA. Members of the EMRWB are appointed by Canada (2), the Government of Nunavut (1) and the Cree Nation Government (3). The members nominate a chair, who is appointed by the Minister of Fisheries and Oceans (Canada) in consultation with the Minister of the Environment (Canada) and jointly with the Minister of the Environment (Nunavut).

The Board has primary responsibility with regards to wildlife management and the regulation of access to wildlife within the EMR. All decisions of the EMRWB are subject to approval by the responsible Minister(s) and may only limit Cree harvesting to the extent necessary to effect a conservation purpose, to give effect to a Total Allowable Take (or TAT) or to the provisions of the EMRLCA arising from the Reciprocal Agreement between the Crees of Eeyou Istchee and the Nunavik Inuit, or for public health and safety reasons. In the case of polar bears, the EMRWB has the authority to establish, modify or remove a TAT and non-quota limitations for the EMR. The EMRWB may also approve the adoption and implementation of a management plan for various wildlife species, including polar bears.

As explained below, the EMRWB is expected to work closely with the Cree Trappers' Association (at the local and regional level) as well as with the Cree Nation Government, the 'government designated organization' (GDO) for these provisions in the EMRLCA. The CTA also has employees who work at the community level (EMR officers), and who have responsibilities for linkages with the Regional CTA on matters of shared concern or responsibility.

6.2.2 Nunavik Marine Region Wildlife Board (NMRWB)

Similar to the EMRWB, the NMRWB is also an independent co-management body, but was established under the NILCA. Members of the NMRWB are appointed by Canada (2), the Government of Nunavut (1) and the Makivik Corporation (3), with the members nominating a chair who is appointed by the Minister of Fisheries and Oceans (Canada) in consultation with the Minister of the Environment (Canada) and jointly with the Minister of the Environment (Nunavut).

The Board has primary responsibility with regards to wildlife management and the regulation of access to wildlife within the NMR. All decisions of the NMRWB are subject to approval by the responsible Minister(s) and may only limit Nunavik Inuit harvesting to the extent necessary to effect a conservation purpose, to give effect to a Total Allowable Take (or TAT) or to the overlap agreements passed with the Crees of Eeyou Istchee, the Nunavut Inuit and the Labrador Inuit, or for public health and safety reasons. In the case of polar bears, NMRWB responsibilities include establishing, modifying, or removing levels of TAT and non-quota limitations for the NMR. The NMRWB may also approve the adoption and implementation of a management plan for various wildlife species, including polar bears.

6.2.3 Government of Nunavut, Department of Environment

Under the NILCA and EMRLCA, the Nunavut's Minister of Environment retains the ultimate authority over wildlife management for species that fall under his or her authority. In the case of polar bears, this authority applies when bears are situated on lands of the NMR and EMR. The Minister of Environment is therefore involved in the approval and implementation of decisions stemming from either the NMRWB or EMRWB as they pertain to polar bears. This process is complex and yet to be formalized although open dialogue and discussion with all stakeholders is currently undertaken.

Department of Environment staff conduct research and undertake population assessments collaboratively on shared populations, providing information for decision-making to all jurisdictions. This information is used by the respective jurisdictions to inform their own processes within their specific context.

6.3 Organizations with roles in Québec and in the Marine Regions.

6.3.1 Cree Nation Government (CNG)

The CNG is the successor (2014) to the Cree Regional Authority, the aboriginal government institution created by the JBNQA. It exercises a number of responsibilities derived from the JBNQA and its implementation, as well as responsibilities derived from the EMRLCA. In some cases, it is the body which, with the Grand Council of the Crees (of Eeyou Istchee) may give valid consent on behalf of the Crees, where this is provided for by law or by the provisions of the JBNQA and EMRLCA. It is the title holder for the islands owned by the Crees along the coast (other than those lands reserved to the Government of Canada). It is fully involved in the implementation of wildlife management regimes in the JBNQA territory, and names the Cree participants in the EMR 'institutions of public government' (wildlife board, planning commission and impact review board).

6.3.2 Local Cree Trappers' Associations (Local CTAs)

There are five coastal Cree First Nations, on the Québec shore. Each Cree First Nation has its own local Cree Trapper's Association, local directors of which also constitute the board of the regional Cree Trappers' Association. The implementation of the EMRLCA, including the provisions relating to SH polar bear subpopulation management, and the reporting of DLP incidents in particular, depends on the close

working relationship between the local CTA's, the regional office, and the Cree institutions of government – the local First Nations and the Cree Nation Government.

6.3.3 Regional Cree Trappers' Association (CTA)

The CTA was created by Section 28 of the JBNQA, and its original mandate was linked directly to the fur trapping and processing economy in the Cree communities. It dealt with the registration of pelts for sale, and this function remains relevant where polar bear hides are registered for sale (the relevant tags are issued by the MFFP). The CTA has taken on a broader range of responsibilities for tracking big game harvests and is in that context a relevant player in the SH polar bear subpopulation management context.

The EMRLCA of 2012 made use of the CTA structure and regional organization and assigned to it a number of functions directly relevant to tracking harvests of wildlife along the coast and formulating recommendations dealing with issues of allocation and reporting. It therefore plays a major complementary role alongside the EMRWB, and maintains a close working relationship – in addition to its JBNQA responsibilities

6.3.4 Local Hunting, Fishing and Trapping Associations (HFTA) / Local Nunavimmi Umajulirijiit Katujjiqatigiinningit (LNUKs)

Each Nunavik community has a local HFTA, composed of members elected within the community. These organizations were first established to act as consultative bodies for issues pertaining to wildlife management within Nunavik, particularly under section 24.5.4 of the JBNQA. Later, the HFTAs assumed the functions of *Local Nunavimmi Umajulirijiit Katujjiqatigiinningit* (LNUKs), as specified in the NILCA. LNUKs are responsible for the management of harvesting by their members (Inuit); they act as consultative bodies on wildlife matters, can make recommendations about wildlife management measures to the *Regional Nunavimmi Umajulirijiit Katujjiqatigiinninga* and are responsible for the management of harvest allocations made by the RNUK at the community level when harvest limitations are established.

6.3.5 Nunavik Hunting, Fishing and Trapping Association (NHFTA) / Regional Nunavimmi Umajulirijiit Katujjiqatigiinninga (RNUK)

The NHFTA (Anguvigaq) is a regional body established to represent the harvesting rights of Nunavik Inuit, particularly under the JBNQA (paragraph 24.5.4). The role of the NHFTA is restricted to matters that affect wildlife harvesting in Nunavik. Like the Local HFTAs, the NHFTA assumed the responsibilities of the *Regional Nunavimmi Umajulirijiit Katujjiqatigiinninga* (RNUK) after signing of the NILCA; the RNUK's mandate is limited to matters affecting the NMR. Among its responsibilities, the RNUK acts as a consultative body on all wildlife matters in the NMR, can recommend management measures to the NMRWB on behalf of LNUKs and is responsible for the allocation of harvest among the LNUKs when harvest limitations are established.

6.3.6 Makivik Corporation

The Makivik Corporation (Makivik) is the legal entity mandated to protect the rights and interests of Nunavik Inuit as they are defined in the (JBNQA) and, more recently, in the NILCA. In this capacity, Makivik is responsible for the appointment of Inuit members to the HFTCC and to the NMRWB. Through its Renewable Resources Development Department, Makivik strives to ensure that the traditions and rights of Nunavik Inuit are respected in all aspects of polar bear management. The department also operates the Nunavik Research Centre, which coordinates a number of programs including those aimed at the

collection of biological samples from various wildlife species, mostly linked to wildlife health and monitoring programs.

6.3.7 Government of Canada – Environment and Climate Change Canada (ECCC)

Under the NILCA and EMRLCA, Canada's Minister of Environment and Climate Change retains the ultimate authority over wildlife management for species that fall under his or her authority. In the case of polar bears, this authority applies when bears are situated on sea ice, or in the waters of the NMR and EMR. The Minister responsible for ECCC is therefore involved in the approval and implementation of decisions stemming from either the NMRWB or EMRWB as they pertain to polar bears.

Under the federal *Species at Risk Act* (SARA), ECCC is responsible for completing a national management plan for polar bears. The Government of Canada has responsibilities for the management of listed species such as polar bears where they occur on federal land. The Government of Canada is responsible for managing polar bears and their habitat on federal lands (e.g., National Parks, National Park Reserves, National Historic Sites, National Wildlife Areas, and Migratory Bird Sanctuaries). The Government of Canada contributes to scientific knowledge of polar bears through research and helps to coordinate polar bear management across the country. Canada is signatory to the 1973 Agreement on the Conservation of Polar Bears and is responsible for coordinating international management actions for polar bears, with the advice of the wildlife management boards and jurisdictions. ECCC is the lead government agency for implementation in Canada of CITES through WAPPRIITA, and for implementation of the *1973 Agreement on the Conservation of Polar Bears*. Environment and Climate Change Canada's Enforcement Branch - Wildlife Enforcement Directorate, is responsible for enforcing laws that protect and conserve migratory birds and protect habitats and species at risk under federal mandate.

Environment and Climate Change Canada and the Gouvernement du Québec (represented, at the time, by: the ministre des Ressources naturelles et de la Faune, the ministre du Développement durable, de l'Environnement et des Parcs, the ministre de l'Agriculture, des Pêcheries et de l'Alimentation and the ministre responsable des Affaires intergouvernementales canadiennes et de la Francophonie canadienne) entered into a cooperation agreement for the protection and recovery of species at risk in Québec in 2012¹⁰³. The purpose of this agreement is to establish the methods by which the Parties will coordinate their activities in relation to the protection and recovery of species at risk of common interest and their habitats and will collaborate in order to avoid duplication. Its purpose is also to encourage the exchange of information and to improve knowledge about species at risk and wildlife species.

7. Threats to the Conservation of Polar Bears

7.1. General Overview of Conservation Threats

In developing a polar bear management plan, it is important to consider all known, anticipated, or possible threats to polar bears, including all human caused mortality and removals. This section provides an overview of the known threats at play within the management plan area, or those that are anticipated to occur within its initial 10-year period of application. The threats presented below were not ranked by order of priority during community consultations, as such they have been listed here in alphabetical order.

Although each issue is described individually, and while investigations into the effects of a project typically focus on local, direct effects, it is important that their cumulative effects be considered by policymakers, especially as northern communities continue to grow. Cumulative effects are changes that are caused by a project-specific action when the effects are combined with other past, present and future human actions. Cumulative effects can occur in several ways but one of the most common forms is associated with development and arises whereby one particular project induces other projects to occur. While it is difficult to tease out climate induced pressures, these should not be overlooked during cumulative impact assessments.

7.2 Development

7.2.1 Hydroelectric Development

Northern Québec, particularly the James Bay region, is well known for the La Grande hydroelectric complex. However, a number of other river systems are identified as having strong hydroelectric potential; these could be developed in the future as energy demands (within or outside of the region) increase¹⁰⁴.

Flow modifications in the James Bay and Hudson Bay watersheds have significantly changed the timing and magnitude of freshwater discharge into the bays. Because water is stored in reservoirs during the spring and summer for release in fall and winter (when energy demands are highest) these hydroelectric developments have reduced the intensity of the spring freshet and resulted in the flattening of the annual hydrograph, when compared to naturally flowing rivers^{105–107}. While there have been numerous predictions about the consequences that such changes would engender within the marine ecosystem^{108–111}, the impacts of hydroelectric development are complex and discerning them from naturally occurring phenomena is difficult¹¹² and very few studies have actually assessed the direct impacts related to hydro development^{113,114}.

That said, Inuit and Cree communities in James Bay and Hudson Bay have raised numerous concerns about the changes in sea ice dynamics that have arisen since the 1970's and their impacts on wildlife and wildlife habitat. They have observed direct linkages between the changes to oceanographic parameters within James and Hudson Bays and changes in the frequency of wildlife ice-entrapments, the texture of sea ice and the quality of wildlife habitat (e.g., disappearance of eelgrass beds¹¹⁴). The observed change in surface salinity has also been attributed to reduced buoyancy in polar bears and ringed seals, who must now expend additional energy to stay afloat. On the other hand, hunters from Inukjuak have reported that the dams led to an increase in open-water areas during winter (because of changes in currents), which provides polar bears a better access to ringed seals¹¹⁵.

7.2.2 Natural Resource and Infrastructure Development

Many mineral deposits in the sub-Arctic and Arctic remain undeveloped due to the lack of infrastructure (e.g., inexpensive and abundant electricity, roads, and ports to bring in supplies and ship out the ore). Other deposits have yet to be discovered owing to the remoteness of the region, the cost of exploration and challenges associated with developing a deposit in the region. Once a mine is built, the associated infrastructure may then be used to develop other nearby mineral deposits. This can lead to cumulative effects on wildlife and their habitat. These effects can take on many forms including habitat destruction and animal/human interactions.

In addition to development occurring in neighbouring jurisdictions, there are two operating mines within the Québec range of polar bears as of 2015^{116,117}. The Raglan Mine has been in operation since 1997 and the Nunavik Nickel shipped its first load of ore in 2014. Both are located in the Deception Bay area, within Hudson Strait. There are other known mineralized areas in coastal Québec, and likely additional as yet undiscovered resources that could be developed in the future. Northern Québec and the adjacent offshore is a vast remote area and much of it has yet to be explored using modern technologies. Furthermore, as global demand and commodity prices increase, mining and processing technology advances, and infrastructure becomes more widespread, interest in mineral development will increase. What qualifies as a mineral occurrence today could become a mineral resource in the future. According to “The Plan Nord toward 2035 – 2015-2020 Action Plan” released by the Gouvernement du Québec in 2015, many investments and the development of the mineral and energy potential of Northern Québec are expected in the upcoming years. The extent of the impacts of such development on polar bears habitat is difficult to predict.

To date most exploration and mining has been inland¹¹⁶, outside of the most frequently used polar bear habitat, and there has been no documented evidence of negative impact on polar bears. That said, given the general absence of roads in the region, most mines will construct infrastructure from the mine to the coast and rely on ships to supply fuel and equipment to the mine and transport the ore to market. Such infrastructure within the range of the polar bears has the potential to impact polar bears if not managed appropriately. The effects of an individual project may be less significant but, when taken into consideration along with other projects or activities in an area, the cumulative effects can become more significant. It is important therefore to take into account the impact of exploration and mining projects, and all other associated impacts within the area occupied by a polar bear sub-population.

7.2.3 Shipping

The potential consequences of shipping on polar bear are numerous and occur as both direct impacts and indirectly via impacts on prey species (i.e. whales, seals, etc.)¹¹⁸. The noise associated with passage of a ship can in itself disturb wildlife in the vicinity of the vessel, particularly during icebreaking activities when disturbance is at a peak. Noise associated with shipping and icebreaking have the potential to alter marine mammal behavior and can mask biologically significant sounds by disrupting their hearing and vocalization abilities^{118–120}. During the ice-free season polar bears tend to be on land or close to shore so the potential for shipping to disturb polar bears is confined to these areas. In periods of extensive ice cover, bears can be observed far from shore, hence the likelihood of ships encountering bears is greater. Under such circumstances shipping may pose a direct threat to polar bears via the possibility of ship strikes, which are also a threat to polar bear prey species, or by causing family groups to become separated. Ice-breaking can also affect the survival and habitat use of ringed seals, and may influence the distribution of their

birthing lairs and disrupt mother-pup linkages^{121–125}. Since ringed seals represent a crucial food resource for polar bears, they could be indirectly affected by such impacts.

Given the relatively low frequency of shipping in ice-filled waters to date, within the management area, routine shipping is of little concern to the polar bear. However, given that the number of shipping transits has increased substantially in recent years¹¹⁷, it is safe to assume that community and natural resource development will lead to a further increase in seasonal shipping and possibly year round activity in the future. As vessel traffic increases, the likelihood of wildlife disturbances can also be expected to increase so the potential effects of such activity would need to be carefully examined and mitigation measures may need to be put in place.

With shipping comes the potential for unanticipated events such as collisions and groundings on shoals. There can also be fuel spills during the transfer of fuel from a vessel to an onshore fuel storage tank. These situations can, if bears are in the vicinity, lead to them becoming covered in oil. Research has shown that such incidences can lead to mortality¹²⁶.

7.2.4 Tourism

Tourism brings more people into areas frequented by polar bears, which can lead to increased disturbance and harassment of the bears, and an increased likelihood of human-bear interactions.

Tourism can be both land-based and marine-based. It can involve individual tourists who travel on their own or in very small groups. They could be hikers or people in kayaks or other small boats. Large groups of tourists may also visit an area at one time (e.g., in one or more tundra buggies or on a cruise ship). While tourist-related activities tend to be confined to particular areas and times of the year, they are often planned so as to maximize the likelihood of bear encounters and photographic opportunities. For this reason, the chances of human-bear interactions and disturbance of the bears are elevated by tourism activities. These effects on their own may not have a major impact on the bears, but when combined with other activities or stressors, the impacts can become serious¹²⁷.

As of 2022, tourism within the region is relatively limited, but as more infrastructure becomes available (e.g., access roads, better airport and harbour facilities, more frequent flights and a longer ice-free shipping season) and communities seek out this economic opportunity, the industry will likely grow. The Cree Outfitting and Tourism Association (COTA) has been actively exploring (2015 – 2017) and evaluating the potential for tourism development based on polar bear viewing, with a particular emphasis on the Twin Islands in central James Bay. COTA's interest in this matter is prompting a critical appraisal of the implementation of polar bear tourism in the Eeyou Marine Region south of the NMR.

It is important to bear in mind that bringing more tourists into the north increases the potential for human-bear conflict and that this can put people's lives at risk, if not properly mitigated¹²⁸. It can also lead to increased bear mortality as a result of the need to protect tourists. It is important to minimize the risks to both people and bears associated with this activity. This can be done in several ways including public education, requirements for trained bear monitors and the development/availability and use of bear deterrent measures (e.g., stun guns, cracker shells, pepper spray and portable electric fences around campsites).

Little is known about the long term effects of polar bear viewing in specific locations where bears are known to congregate¹²⁷. Some people have suggested that the bears in these areas become habituated

to the sight of humans and lose their fear of people. If true, this could lead to increased human-bear conflicts.

7.3 Pollution and Contaminants

Arctic marine mammals acquire chemical contaminants through their diet. Polar bears, being at the top of the Arctic marine food chain, accumulate one of the largest contaminant loads amongst all Arctic marine mammals. The Arctic marine environment has a high-fat food web and the great majority of persistent organic pollutants (POPs) accumulate in the fat of all Arctic animals. Most of these chemicals are highly persistent and continue to build up in the animals throughout their lifespan. The chemicals found in polar bear tissues are complex, with over 250 chemicals having been detected. These include POPs such as polychlorinated biphenyls (PCBs) and chlorinated pesticides as well as brominated flame retardants (BFRs) and perfluoroalkyl substances (PFASs). Redistribution of accumulated POPs to target organs such as the liver due to mobilization of fat reserves during fasting and starvation is of particular concern. Although POPs have been detected in tissue samples of all polar bears examined throughout the Arctic, polar bears from the Canadian Arctic appear to have lower chemical loads than elsewhere. As of 2016, Canadian researchers funded by the Northern Contaminants Program are at the early stages of comprehensively establishing spatial and temporal trends of chemical contaminants in polar bears of the Canadian Arctic¹²⁹.

A high contaminant load in polar bears might impact their hormonal and immune systems and potentially can affect growth, development, reproduction and resistance to diseases; subsequently lessening their survival ability in face of other environmental challenges. Despite high contaminant loads often reported in polar bears, it is difficult to verify a direct link between contaminants and the survival of polar bears at the present stage of research¹³⁰. Some studies reported correlations between contaminant loads and occurrence of physiological and morphological anomalies such as weakened bones and decreases in levels of certain antibodies in blood and changes in vitamin levels. However, the cause-effect relationship between these observations and contaminants has yet to be established. At this point, no neurological or behavioral manifestations of polar bears in the wild can be indisputably attributed to chemical contaminant exposure. Because of the iconic status of the polar bear and the intense media attentions on the subject, implications of subtle changes detected at biochemical and molecular levels are often loosely extrapolated to predict serious adverse effects on the survival of the species.

Within the management plan area, there is a considerable knowledge gap as far as contaminant research is concerned in comparison with the rest of the Canadian Arctic. Mercury is the only metal contaminant that also biomagnifies up food chains like POPs. The target organ of mercury toxicity is the central nervous system. The only published study of contaminants in Nunavik polar bears^{131,132} studied the effects of mercury exposure on polar bear brain chemistry and found that mercury concentration in polar bear brains was over 600 times lower in Nunavik than on Eastern Baffin Island.

7.4 Parasites and Disease

Although infectious agents such as parasites and disease can have important effects on the health of individual animals and at the population level, very little research has been directed at understanding their epidemiology and ecological significance in polar bears¹³³. That said, polar bears are known hosts for zoonotic parasites such as *Trichinella* and *Toxoplasma*^{134–136} and to a variety of other diseases¹³³ including rabies¹³⁷ and canine distemper virus¹³⁸, many of which can have impacts on human health if polar bear

meat is consumed without proper preparation or individuals are exposed to a virus through human-bear interactions.

It is possible that a warming Arctic environment will increase the number of pathogens that polar bears are exposed to, in the management plan region, through mechanisms such as range expansion or increased polar bear density, resulting from reduced habitat during summer. It is also anticipated that, as more invasive species occur in the region, and as new pathways for pathogen transmission are opened up, polar bears will be increasingly at risk of higher prevalence of parasites and disease^{133,139–142}. The impacts of parasites and diseases may also be exacerbated by the other pressures (shipping, habitat loss, dietary changes, pollution, etc.) facing polar bears¹⁴⁰.

7.5 Climate Change

In addition to observed trends^{143,144}, climate models are used to create projections of future climate scenarios. They utilize historical data to predict what changes in climate may be anticipated in the future, and usually they predict a range of scenarios. Although climate models are generally accurate at predicting near-term changes, their predictive ability decreases the longer they project into the future; they are also of limited use when used to predict precipitation patterns¹⁴⁵. Despite the limitations of climate models, almost all models currently being employed indicate a warming of the Arctic in the near to long term^{146,147}. Many Inuit and other northern inhabitants have already noticed these changes taking place¹⁴⁸. Along with warming temperatures, one of the other consistent predictions of the climate models is an increase in the variability of weather patterns, which Inuit have also witnessed in the last 15-30 years^{145,148}.

Many scientists consider climate change to be the most critical long-term threat to polar bears and their habitat^{67,77,149–151}. Projected warming over much of the polar bear's range and associated reductions in the thickness, duration and extent of sea ice will have both direct and indirect effects on polar bear. Direct effects could include loss of habitat (i.e. extent and composition of sea ice) whereas indirect effects could include ecosystem-level changes affecting the availability of prey species¹⁵². Earlier melting of sea ice in the summer and later formation of sea ice in the fall will likely also result in greater reliance by bears on terrestrial coastal areas^{153,154}. However, habitat changes are not necessarily associated with a reduction in the carrying-capacity of polar bear habitats. For instance, loss of multi-year ice is usually accompanied by an increase in annual sea-ice, and annual sea-ice is thought to be more optimal habitat for polar bears^{150,155}. As well, variability within each ecosystem means that some years will be more productive for polar bears than others, and although there might be a general trend towards warmer temperatures and less sea-ice, ecosystem responses and trophic relationships are currently poorly understood.

In addition to habitat alterations noted previously, climate change is also expected to influence the energy budget of polar bears as the abundance of prey species and access to them changes. It is generally accepted that ringed seals predominantly hunted from a sea ice platform constitute the bulk of polar bear diets in many parts of their range^{36,41}, and that bears rely heavily on accumulated energy reserves to survive the ice-free summers that occur within the management plan area. That said, it is known by the Crees and Inuit that polar bears can effectively hunt seals in open water, this behavior has rarely been documented⁵¹ so its contribution to the annual energy budget of polar bears is not well understood. It should be noted that polar bears in Davis Strait rely less heavily on ringed seals and have a higher proportion of harp seals in their diet than any other polar bear subpopulation²¹.

Reduced ringed seal foraging opportunity may also result from impacts of climate change on the seals themselves. Although there is some uncertainty regarding how ice-dependent prey species (i.e. bearded seals, ringed seals, walrus, etc.) will respond to changes in snow and ice conditions, an overall reduction in their abundance is expected^{152,156}.

Although polar bears are known to forage on a multitude of other prey species^{36,37,49,50,115,157,41–48}, their ability to compensate for a reduced availability of ringed seals by increasing their take of other species remains contentious among scientists and the full effects of a shift in polar bear diet due to climate change are currently unclear^{158–160}.

Climate change could also affect polar bear maternity dens. Within the region covered by this management plan, female polar bears den on both the offshore islands and onshore, and create dens in large snow drifts or by excavating soil and peat. Increased variability of temperatures and precipitation could damage the structural integrity of these dens under certain conditions¹⁵³.

7.6 Unsustainable Harvests

Harvest management represents a critical requirement for the long-term maintenance of healthy wildlife populations. While the current informal management system has been sufficient to manage the polar bear harvest in the past, changes in current practices and realities have to be considered and the management of wildlife resources have to be adapted to the present situation. Communities are growing, hunting equipment is modernized and the harvest of polar bears from the region has seen high variability over the past decade.

These facts, along with the greater uncertainty of the effects of other threats facing polar bears, suggest that the risks of attaining unsustainable harvest levels could increase over time. Proper monitoring and management of the resource are therefore essential to ensure that polar bears will remain available for use by future generations of Crees and Inuit. This, while taking necessary steps to avoid human/bear conflicts in this ever-evolving landscape.

8. Management Challenges

8.1 Research and Monitoring

The conduct of scientific research and the documentation of tradition knowledge are the cornerstones of sound polar bear management. Although both fields have undergone significant changes in recent years, they continue to face a number of challenges and criticism of research techniques is common in each.

In the case of Traditional Knowledge studies, there has been a marked effort to ensure that research results will be considered as more than anecdotal accounts and rather as valid representations of a knowledge system¹⁶¹. More structured and replicable study methods, including pre-study community consultations, reflective development of interview guides, and rigorous post-analysis validation and verification workshops with participants have allowed Traditional Knowledge to be assessed quantitatively and viewed as a valuable source of reputable information^{162–164}. Traditional Knowledge study methodology continues to grow, with many researchers using spatial methods, such as participatory mapping, to aid in the transmission of knowledge beyond interviews and questionnaires^{165,166}.

For scientific research the obstacles have been different. For many years, Inuit communities have been opposed to the handling of polar bears for research because doing so is directly at odds with their fundamental values, of which respect for wildlife is paramount. Most Inuit view invasive research on animals as a form of disrespect to the animal. Because Inuit consume the polar bears that they have harvested, the use of tranquilizers also directly affects food security since most hunters and Inuit families will not eat a polar bear that has previously been drugged. Hence, for Inuit the harm associated with handling polar bears often outweighs any knowledge gains. Conversely, for the scientific community, capture and handling is seen as the most reliable means (and in some cases the only way) of collecting biological information, especially as it relates to research on body condition and survival, or for habitat and movement studies. As such, the effects of capture are often considered acceptable relative to information needs and the risks posed by harvesting¹⁶⁷. This divergence between the two perspectives has often led to frictions between the scientific community and Inuit but has also led to innovative and less intrusive scientific research methods (e.g., aerial surveys, biopsy darting, hair snags, etc.). Given these issues, it is important to review some of the facts surrounding the various research methods and the consequences of moving towards less intrusive techniques.

One of the major research-related concerns raised by Inuit communities has been the use of immobilizing drugs during physical mark-recapture and telemetry studies which leads to the wastage of polar bear meat, because most Inuit consider it unfit for consumption due to fears of contamination and/or a different taste^{38,115,168}. While few studies have directly assessed the withdrawal time for immobilizing drugs in polar bears, one revealed that Telazol® was almost entirely cleared from the body within 24 hours but that some metabolites remained at very low levels for an indeterminate period of time¹⁶⁹. Health Canada had originally recommended a 1-year waiting period before consuming the meat from a polar bear that had been immobilized¹⁷⁰, but later revised this time frame to 45 days after a review of the scientific data and extensive consultations, consistent with the withdrawal period recommended by the United States Centre of Veterinary Medicine. Any animal immobilized using Telazol® must therefore be identified by some external marker that indicates the date of the latest treatment with the drug. Despite these guidelines, most Inuit will refrain from eating a polar bear if it has ever been chemically immobilized.

Hunters have also reported physiological and/or behavioural changes in bears that have previously been handled by researchers, especially those having been marked with collars or ear tags, and call for the use of less invasive methods³⁸. In contrast, assessments of the impacts of chemical immobilization on the movement rates of polar bears found that movement patterns generally returned to normal within a few days after capture^{149,171}, though for some bears it took up to 21 days before normal movement patterns resumed¹⁷². A similar study on grizzly bears and black bears found that their movements were reduced for 3-6 weeks after capture and that, individuals having been captured on multiple occasions had poorer body condition than bears of the same age that had been captured on only once¹⁷³. While this suggests long-term effects of capture and handling may also exist for polar bears, recent findings indicate that this is not an issue in the southern Beaufort Sea subpopulation¹⁷¹.

In response to the concerns expressed about chemical immobilization by aboriginal groups, and also to address the logistical complexities of carrying-out physical mark-recapture studies in some parts of the Arctic, significant effort has been dedicated towards developing less invasive monitoring techniques. For example, hair samples provided by hunters, or those that have been collected with the use of hair snags have proven useful for studying stress levels in polar bears¹⁷⁴ and show promise with regards to genetic

mark-recapture studies^{52,175}. More significantly, population estimates in most areas have evolved from physical mark-recapture to the less invasive methods of genetic mark-recapture (using biopsy darts and samples of meat collected by hunters)¹⁷⁶ or aerial surveys^{177,178}. These methods can also be used to obtain limited information on body condition, litter size, and cub survival rate but provide considerably less information than traditional mark-recapture studies¹⁶⁷.

8.2 The Human Dimension

8.2.1 Harvesting and Harvest Management

At the time this document was prepared, there was no formal polar bear management system in place within the management plan area. However, a set of regulations (hereinafter referred to as the 1984 Anguvigaq Polar Bear Regulations) developed by the Anguvigaq, at a meeting with the Gouvernement du Québec (the then Ministère du Loisir, de la Chasse et de la Pêche) has played a significant role in shaping polar bear hunting practices since the 1980's. Indeed, Nunavik Inuit presented a series of polar bear regulations to the HFTCC, in 1984. The HFTCC unanimously supported these regulations, yet this did not translate to the adoption of formal regulations by the Gouvernement du Québec, thereby maintaining the voluntary nature of the regulations.

Among other provisions, the regulations set out harvesting seasons, prohibits the harvest of cubs or females with cubs (although cubs were traditionally harvested for their more tender and better tasting meat) and prohibit the disturbance of denning bears. In addition to this, polar bear harvesting is guided by the age-old stewardship practices that require hunters to take only what they need, and to always show respect to animals with whom they share the habitat.

1984 Anguvigaq Polar Bear Regulations

1. That a closed season on polar bear hunting be in effect from June 1st to August 31st.
2. That female bears with cubs not be killed at any time of the year unless they are problem bears.*
3. That polar bears not be killed in their dens. Further, that no one, including scientists and Inuit, disturb a bear in its den unless authorized after consultation with Anguvigaq Wildlife Management Inc. and review by the Hunting, Fishing and Trapping Coordinating Committee.
4. That polar bears less than 2 years old not be killed at any time of the year unless they are problem bears.*
5. That polar bear cubs not be sold to any person or organization unless authorized after consultation with Anguvigaq Wildlife Management Inc. and review by the Hunting, Fishing and Trapping Coordinating Committee.
6. That the responsibility for issuing polar bear tags to Inuit hunters rests with the local government municipal corporations in northern Québec.
7. That the moratorium on drugging polar bears in northern Québec be continued.
8. That each Inuit community will recognize the right of all other Inuit communities to harvest polar bears and will continue to help each other in matters relating to polar bears.

* Problem bear is defined as any polar bear that is a threat to life or property.

Harvest management involves the use of various rules and policies to achieve pre-determined management objectives that have been established based on the abundance of a population, carrying-capacity of the habitat, safety concerns, etc.). It can include tools such as seasonal limits, protection of certain segments of the populations (e.g., females and cubs) or the imposition of a limit on the total number of individuals that can be removed from the population. Harvest management also includes the distribution of the products of the harvest among the various users.

The challenge with implementing such a comprehensive management system in Nunavik is that the region's primary experience with a formal management system (implemented since the 1980's for beluga whales) has been highly controversial and with profound impacts on Nunavik Inuit¹⁷⁹. As a consequence, Nunavik Inuit are generally wary whenever there are talks of implementing harvest restrictions for polar bear, as they worry that similar circumstances will arise. A primary concern relates to possible impediments on the transfer of knowledge and on use of traditional hunting areas, resulting in a young generation without a full complement of land skills. Further, the imposition of quotas is believed by many Inuit to have inadvertently caused an increase in harvesting pressure as hunters have rushed to fill quotas and maintain their access. During interviews with Nunavik Inuit, there was widespread concern that the implementation of a quota system for polar bear may have the same unintended effects^{38,115}.

8.2.2 Changing Communities

In recent times, the communities of Northern Québec have undergone, and continue to undergo, a number of significant changes¹⁸⁰. Aside from the drastic changes that came with a more sedentary way of life, today's communities are experiencing rapid population growth. The region's birthrates are among the highest in the country and the demographic structure has shifted to one dominated by youth¹⁸¹. Unfortunately these changes have not been accompanied by an increase in job opportunities and social issues are numerous¹⁸². The extremely high cost of living, driven by high prices for food, fuel and equipment, is one of the main hardships faced by residents in many communities^{183,184}. Despite these significant changes, subsistence harvesting has persisted as one of the most important threads of society. It allows for a source of healthy nutrition and instills a source of pride and fulfillment to the harvesters.

The modernization of equipment has impacted harvesting practices in Northern Québec. Modern equipment such as snowmobiles and all-terrain vehicles has improved access to wildlife and, along with more technologically advanced firearms, has, in some sense, made harvesting more efficient. However, the high costs associated with this equipment means that such hunting practices have become unaffordable for many Inuit and Crees.

8.2.3 Defence of Life and Property

Although Crees and Inuit have co-existed alongside polar bears for millennia, their interactions have been changing in recent years to the point that they no longer feel safe while camping on the land^{38,115}. The changes to communities, noted above, are one of the key factors driving these conflicts. Growing settlements and changing lifestyles have certainly created conditions in which there is a greater likelihood of encounters between humans and polar bears. Among these factors are the growing number of cabins/tents on the land, growing landfills and, generally, a greater human-presence. In the case of Inuit and Crees, the advent of snowmobiles means that protection from polar bears by dog teams is no longer a reality for most people when they travel outside their community.

That said, Inuit and Crees continue to feel that many of these encounters are the result of a significant increase in the number of polar bears present in the region compared to the 1950's and 1960's. Polar bears are now a regular occurrence in areas where they were once a rarity. Lengthening of the ice-free season means that polar bears spend more time on land, which also increases the likelihood of encounters; according to the projected climate change scenarios, this is a problem that is likely to worsen. The depredation of seabird/waterfowl colonies by polar bears has become a regular occurrence¹⁸⁵ and, given the importance of these colonies (e.g. eggs, feathers, meat, etc.) to the subsistence of Inuit and Crees, is likely to lead to increased human-bear encounters. Their inquisitive nature means that polar bears are naturally drawn to human settlements (camps, cabins, communities, butchering sites, etc.), and therefore towards situations of possible conflict. In addition to a number of known attacks on humans, the destruction of cabins, food caches, and equipment by polar bears is a growing concern. Some hunters have noted that bears are more aggressive in recent years, so what may previously have been a harmless encounter may now be deadly (for humans and bears). During interviews, many Cree hunters and trappers have mentioned a strong increase in presence of polar bear, as well as their distribution area expanding south. This has led to an increase in human-bear conflicts over the last decades, more dramatic in the last few years. Many mention changes in behaviour as well, as the polar bear seems to come more to shores and more inland, presumably because of changes in ice conditions and/or availability of food sources. Should bears become nutritionally stressed in the future, these problems are expected to be intensified.

Conditions are such that human-bear interactions have become unavoidable and are a key consideration and priority in the management of polar bears, for both Crees and Inuit. As well, an increased human presence in the North has resulted from the presence of outfitting camps, tourism operations and mineral prospecting sites (among others) and will continue to grow in the future.

8.2.4 The role of Zoos and Aquariums

The role of zoos and aquariums in promoting wildlife conservation has long been recognized, but it is not without debate; especially concerning matters of ethics and animal welfare. In the case of polar bears, orphaned cubs are occasionally sent to zoos instead of being euthanized.

Placing and raising polar bears in zoos and aquariums provides certain contributions to polar bear conservation. For example, they provide a unique setting for research to be carried out in a controlled environment and could contribute to maintaining a diverse gene pool if wild populations decline. Despite this, Nunavik Inuit (as well as some Cree) have been particularly vocal about their belief that placing polar bears in zoos and aquariums shows a fundamental lack of respect for the animals and disrupts the harmonious balance of humans, animals, and the environment in which they exist. Consequently, many Inuit and Crees are of the view that killing an orphan bear is more humane than sending it to a zoo or aquarium.

Zoos and aquariums also play an important role in public education. Having bears in these facilities enables the general public to view polar bears, learn about their biology and become more familiar with the threats they are facing. While such messaging can encourage public engagement in issues such as reducing greenhouse gas emissions, there is a risk that Indigenous knowledge be under-represented. Indeed, several Inuit were concerned that zoos and aquariums had contributed to mounting public opinion against subsistence harvesting of polar bears.

8.3 Additional Considerations Related to Polar Bear Management

8.3.1 Subpopulation Boundaries

As explained previously, the current polar bear subpopulation boundaries, based largely on movement patterns, mark-recapture and harvest data, are disputed by indigenous harvesters who have a more holistic view of polar bear distribution. Despite significant data on the movements and distribution of female polar bears, males are poorly studied in this regard since they cannot be fitted with satellite collars, due to their large necks relative to their head size. Consequently, it is possible that boundaries are biased by the weight of data obtained from females. Although assessments of population structure based on genetics show some degree of genetic structuring between subpopulations, they also exhibit extensive gene flow amongst them^{186–188}. Nunavik Inuit reported common polar bear travel routes that cross subpopulation boundaries. This includes routes over land across Nunavik, from Ungava Bay to Hudson Bay hundreds of kilometers inland^{38,115}.

8.3.2 Inter-jurisdictional considerations

Considering that polar bears present in the area of application of this plan are shared with several other jurisdictions, it is essential that management actions by individual jurisdictions are established in a coordinated manner for a successful management of the species. The three polar bear subpopulations in the region are shared with Nunavut, Ontario, Newfoundland & Labrador, and/or Greenland as well as falling under the management authority of at least two other wildlife management boards and multiple Inuit and Aboriginal stakeholders. While the management authority of each is limited to the geographical boundaries of their jurisdiction, there are several elements in place that mitigate any adverse impacts this reality might have on achieving the goals and objectives of the present Management Plan.

In the past, when management decisions have occurred, they have usually been taken independently and with little or no coordination with other jurisdictions. This has led to situations where management objectives between jurisdictions might not be shared, resulting in higher harvests in some areas than would normally be sustainable. However, since 2010, greater coordination has taken place in the form of user-to-user meetings with stakeholders from all jurisdictions, as well as greater awareness and communication between wildlife management boards in their decision-making processes. Governments, Wildlife Management Boards and Indigenous Land Claims Organizations with management authority for the polar bear subpopulations across Canada (both inside and outside the geographic scope of this management plan) regularly work together through domestic committees such as the Polar Bear Administrative Committee, the Polar Bear Technical Committee, and advisory committees to coordinate their management decisions; international collaboration and coordination occurs mainly via the Polar Bear Range States.

8.3.3 Legislative Issues

The legislative and regulatory frameworks adopted by the competent authorities are the primary instruments used to give effect to management plans. Without legislation and regulations, the restrictions included within a management plan cannot be enforced. Although legislation and regulations currently applicable within the management plan area (see section 5.4, above) allow effective implementation of the plan throughout most of the region, there remain some legislative gaps due, primarily, to the complex jurisdictional framework described previously (see section 6, above).

For example, while social acceptability remains unclear, a number of Inuit hunters have demonstrated interest to explore the option of establishing a polar bear sport hunt in Nunavik as a means to promote traditional skills and values related to polar bear hunting (e.g., dog sledding) and to optimize the economic returns associated with each bear that is harvested in the region. While sport hunting of polar bears could be permissible in the marine regions under the NILCA and EMRLCA, the polar bear is a reserved species for the exclusive use of Native people according to section 24.7.1 of the JBNQA. The *Act Respecting the Hunting and Fishing Rights in the James Bay and New Québec Territories*⁹⁰ gives effect to this article of the JBNQA by reserving polar bear for the exclusive use of the Native people. The incoherence between the onshore and offshore regulatory and Land Claims regimes are a clear impediment to the implementation of a polar bear sports hunt within the management plan area.

8.3.4 International Trade

Decisions regarding the allowable trade of polar bears can have indirect consequences on Canada's domestic polar bear management efforts, including those within the management plan area¹⁸⁹. Decisions on allowable polar bear trade are made internationally under the *Convention on the International Trade in Endangered Species of Wild Fauna and Flora* (CITES), unilaterally by other countries, and within Canada prior to export. A primary consideration in all of these decisions is the sustainability of harvest in consideration of the conservation status of the species. International trade offers a significant source of income to some Inuit and continued trade is therefore an important incentive to adopt enhanced conservation measures, including sound harvest management practices and accurate harvest reporting. Eliminating the potential for international trade would severely reduce this incentive.

Polar bears are currently listed under Appendix II of CITES. As required under CITES, an export permit for an Appendix II species can only be issued once the CITES Scientific Authority of Canada (housed within Environment and Climate Change Canada) has advised that such export will not be detrimental to the survival of that species. This "Non-detriment finding" (NDF) evaluation of sustainable harvest levels is supported by a demonstration of sound harvest management practices and accurate harvest reporting. This NDF evaluation in part, explains the need for elaboration of this management plan.

It should be noted that in recent years, a number of submissions to uplist the polar bear onto CITES Appendix I have been made (but have not been adopted); if adopted in the future, such an uplisting would end commercial international trade of polar bear. The Government of Canada and Inuit organizations have argued consistently that listing polar bear under CITES Appendix I would almost certainly be of minimal conservation value since international trade is not the main driver behind Inuit harvesting. As well, in September 2015 the Animals Committee of CITES determined during the CITES significant trade review process that the current trade in polar bear hides and parts is not detrimental to the survival of the species in the wild. International trade does, however, offer a significant source of income to some Inuit and is therefore an important incentive to adopt enhanced conservation measures.

9. Management Plan Goal and Objectives

The fundamental mechanism of a management plan is to identify a small number of overarching objectives that should be met in order to meet the overall goal of the management plan. The goal of this management plan is to maintain healthy polar bear populations which remain an important component of the local ecosystem and which will be available for use by current and future generations in a way that respects and embodies the rights, culture and traditions of the Nunavik Inuit and the Crees of Eeyou Istchee. This goal applies to the territories covered under the James Bay and Northern Québec Agreement, the Nunavik Inuit Land Claims Agreement and the Eeyou Marine Region Land Claims Agreement. In order to achieve this goal, four objectives have been developed and the plan identifies specific approaches that must be implemented in order to accomplish each of the broader objectives. The objectives and approaches defined below have been developed based on the views collected during public consultations conducted in Nunavik and in the Eeyou Istchee territory, and on an understanding of polar bears, their habitat and the issues facing them in the management plan area.

Objective 1: Establish a management system based on the best available information, which reflects Inuit and Cree values, and adapt it as necessary to ensure the long-term persistence of polar bears in the management plan area.

Approach 1.1: Review and, as appropriate, renew the 1984 Anguvigaaq Polar Bear Regulations and all commitments made therein.

As indicated in section 8.2.1, these regulations were developed by the Inuit as a conservation effort to respond to concerns raised by the Polar Bear Technical and Administrative Committees and were subsequently adopted by the HFTCC in May 1984. Crees from Eeyou Istchee were however not involved in their development and many current Inuit hunters have indicated that they are unfamiliar with these regulations. It is therefore necessary to review these regulations to ensure that they are supported by all stakeholders, remain relevant, are in line with the current management plan and that they are consistent with the applicable legislative framework, including the JBNQA, NILCA and EMRLCA. As appropriate, they may become enshrined within the regulations established by the responsible governments, subject to the processes defined in the JBNQA, NILCA and EMRLCA.

Approach 1.2: Base polar bear management decisions upon best available information.

To the extent possible, scientific research, Inuit Qaujimajatuqangit and Cree knowledge should be considered and integrated when population objectives and management measures are established. Ecosystemic considerations related to polar bear habitat and prey should be also taken into account.

To achieve this, they require access to multiple lines of evidence, including those provided by TK holders, academics, government representatives and institutional representatives. Clear policies and/or guidelines for the consideration and integration of science and TK would aid decision-makers in their effort to create a fully representative management system.

Approach 1.3: Revise the harvest registration process with the goal of achieving complete reporting of all human-caused mortality of polar bears.

Historically, within the management area, the registration of harvested bears has been voluntary and restricted primarily to those animals whose pelts or other parts are sold. Bears whose skins were used locally for clothing, or other traditional crafts, may not have been reported.

Independent of population status, the effective management of polar bears relies on the ability to collect accurate and reliable harvest information. Several gaps have been identified within the registration process currently applicable within the management plan area. A structured review of current practices should lead to a strengthening of the existing harvest registration process, or to the implementation of an entirely new system. Ultimately, the objective of this review is to establish a mechanism that ensures the full reporting of all human-caused polar bear mortality within the management plan area, including in defense of life and property.

Approach 1.4: Implement a harvest management system that provides the tools necessary to achieve agreed-upon management objectives and long-term persistence of polar bear populations; these can include mechanisms such as NQLs and TAT.

In contrast to most other jurisdictions that allow the harvest of polar bears, there is currently no formal or legislated management regime within the management plan area. However, based on the principles of conservation, the JBNQA, NILCA and EMRLCA provide mechanisms for the establishment of harvesting regulations, to the extent that they are necessary to maintain vital, healthy wildlife populations capable of sustaining present and future Cree and Inuit harvesting needs.

This management plan does not, in and of itself, establish any quota or non-quota limitations. Instead, it provides the initial framework upon which a formal polar bear harvest management system will be built. Upon completion and approval of the management plan, management partners will review all existing management measures, as well as the best available science, Inuit Qaujimajatuqangit and Cree Knowledge for each polar bear subpopulation. This exercise will allow them to assess the status of each subpopulation and the efficacy of the existing management system, to ensure that harvest levels are sustainable. If a conservation concern is identified, a collaborative effort by all management partners must be made to identify the most appropriate management measures. For certainty, a lack of consensus amongst the management partners about the existence (or absence) of a conservation concern and/or about the proper course of action shall not limit the ability of individual parties to propose management measures.

If the existing management system is deemed to be inadequate and formal modifications to the management regime are necessary, they will be implemented in accordance with the processes defined under the JBNQA, NILCA and EMRLCA¹. Decisions should be made in accordance with the principles of

¹ As identified within the NILCA and EMRLCA, the establishment, modification or removal of TAT and non-quota limitations, within the EMR and NMR, is the responsibility of the EMRWB and the NWRWB respectively, while remaining subject to final acceptance/rejection/variation by the federal and Nunavut governments. On the Québec mainland, the HFTCC has a responsibility to make wildlife management recommendations to the ministre des Forêts, de la Faune et des Parcs (or only MFFP), including regulations and restrictions on the harvest when necessary. For clarity, nothing in this management plan

conservation and consider the ecologically sustainable harvest rate for polar bears, as well as the quality of available information. They should also consider current and historical harvesting practices (including those outside of the management plan area), as well as the social acceptability of the current polar bear abundance. Finally, management decisions should attempt to strike a balance between conservation and the need to preserve Inuit and Cree harvesting rights, culture and traditions. The table below is intended to provide guidance to management authorities as they determine the most appropriate management actions to be implemented depending on the circumstances observed.

shall limit the ability of these governments and boards to consider any information that they consider relevant to the decisions before them.

Parameter	Status	Management Actions
Population abundance and trend	Population is considered healthy, abundant and appears to be stable or increasing (according to science and traditional/local knowledge).	- Maintain current frequency of population assessments; - Maintain or reduce harvest restrictions to ensure that they do not unduly limit harvesting rights;
	Population status represents a conservation concern ² (according to science or traditional/local knowledge).	- Increase frequency of population assessments; - Establish or amend harvest restrictions (e.g., TAT, NQL, etc.) to attain lower harvest levels; - Develop educational/hunter information tools; - Take appropriate management actions to address potential causes of population decline (threats) if the primary cause is not thought to be unsustainable harvesting.
Harvest level ³	Harvesting practices for a given subpopulation allow for the maintenance of vital, healthy polar bear populations.	- Maintain or reduce harvest restrictions to ensure that they do not unduly limit harvesting rights;
	Harvest level for a given subpopulation is not in line with the principles of conservation.	- Establish or amend harvest restrictions (e.g., TAT, NQL, etc.) to attain lower harvest levels; - If due to high number of DLP kills, review and improve the available toolkit (e.g., develop educational tools, establish/amend deterrence programs and community bear plans, etc.);
Reporting of harvest	Harvest reporting is incomplete	- Take necessary measures to ensure complete harvest reporting (educational tools, review and improve registration process, put a regulatory mechanism in place, etc.);
Sex ratio of the harvest	Male:female harvest ratio is consistent with management objectives	- Continue monitoring the male:female ratio through harvest reporting;
	Male: female harvest ratio is inconsistent with management objectives	- Develop relevant educational tools; - Establish NQL to achieve a male-biased harvest or employ some other means to achieve the same objective.

² Although a population decline does not necessarily equate to a conservation concern, when a downward trend in abundance or in the health/body condition of polar bears is observed or when harvesting practices may compromise the long-term persistence of polar bears, precaution is warranted when determining appropriate management actions.

³ A sustainable harvest level can vary according to the population objective but must remain in line with the principles of conservation. A 4.5% harvest rate, at a 2:1 male-to-female ratio, has usually been considered sustainable and often allows for the maintenance of stable populations¹⁹⁰. Because higher/lower harvest rates may be appropriate under some circumstances, numerous factors should be examined to determine the sustainability of the harvest (e.g. subpopulation abundance, vital rates, demographic parameters, environmental conditions, polar bear body condition, etc.).

Approach 1.5: Annually review all pertinent information to inform adaptive management of polar bears.

The responsiveness of an adaptive polar bear management system is contingent upon frequent review of the best available information by the management partners and subsequent adjustment of the approach taken. As described in Approach 1.4, information relative to the abundance, harvest and health of polar bears, among others, should be reviewed annually, or whenever significant new information becomes available. Annual review meetings will provide an opportunity to set research priorities and to track the implementation, progress and effectiveness of management actions.

Approach 1.6: Ensure, as appropriate, the protection of young bears and females.

The 1984 Anguvigaaq Polar Bear Regulations included protections for polar bears less than two-years-old. The protection of young bears, who are still dependant on their mothers, aids the recruitment of new individuals into the population and is thereby important to the maintenance of healthy polar bear populations. Mechanisms that continue to ensure the protection of young bears are therefore necessary, except in defense of life and property situations or when there is little likelihood of it surviving.

Sex-selective harvests, whereby females receive added protections, are used frequently by wildlife managers who seek to restore a depleted population or who wish to maximize harvesting opportunities. A number of the 1984 Anguvigaaq Polar Bear Regulations were intended to afford such protections to female bears (i.e., regulation 2: protection of family groups, regulation 3: denning polar bears). In part because of these guidelines, female bears have historically not exceeded one third of the overall harvest within the management plan area (a ratio that is consistent with other jurisdictions). Appropriate actions (e.g., hunter education, regulated sex-selective harvest, etc.) will need to be considered if the proportion of females in the harvest increases to unsustainable levels.

Approach 1.7: Explore the implications and social acceptability of implementing a polar bear sport hunt and, as appropriate, identify the means by which such an activity could be established.

A number of Inuit communities within Nunavik have expressed an interest to carry-out polar bear sport hunting, whereas others have indicated that no such activity should occur within the management plan area. Sport hunting is seen by some as a means of generating much needed income and as a way to strengthen traditional practices such as dog sledding. On the other hand, the concept of trophy hunting is viewed negatively in many circles. There are also a number of obstacles (including the need to establish a TAT) that must be addressed before a sport hunt can be implemented (see section 8.3.3, above). A clear mandate is needed before significant time and resources are invested towards this enterprise.

Objective 2: Collect Traditional Knowledge and scientific information related to polar bears to inform management decisions.

Polar bear research within the management plan area has historically been limited, in contrast to other jurisdictions. This has changed in recent years as increased inter-jurisdictional collaboration, concerns about the impacts of climate change on polar bears and a push to gather Traditional Knowledge have led to a more concerted research effort.

For sound management of the region's polar bear subpopulations, it is important to maintain this momentum going forward. Doing so will require the use of scientific methods, Traditional Knowledge and continued collaboration between all parties. The identification of clear research priorities,

meaningful involvement of Cree and Inuit in research and timely communication of results back to management authorities will further strengthen the polar bear management system.

Approach 2.1: Ensure coordination and collaboration towards monitoring the health and abundance of polar bears, at a frequency that allows robust decision-making.

All three polar bear subpopulations occurring in the management plan area are shared with neighbouring jurisdictions. Consequently, collaboration with partners in other jurisdictions is important to ensure efficient use of resources as well as the complementarity of research methods and priorities between regions. Discussions regarding the sharing of raw and interpreted data as well as research reports are also necessary to ease the collaboration between management partners.

Continued monitoring of abundance and trends is central to the polar bear management system and must occur at regular intervals that are of such frequency to allow for responsive management actions. A sound understanding of polar bear health will also require collection of information about behaviour, body condition, diet, contaminants, disease, parasites, etc. A dedicated effort from harvesters (e.g. via implementation of a sampling program) will be helpful to offset the loss of biological information stemming from the shift away from more invasive research methods.

Approach 2.2: Document the Traditional Knowledge of Nunavik Inuit and the Crees of Eeyou Istchee to inform research and guide management efforts.

Cree and Inuit harvesters are best positioned to provide a long-term perspective on polar bear abundance and health in the region. Given their ongoing close connection to the land, they are also well-situated to provide current observations related to changes in health, abundance, behaviour of polar bears as well as changes in their habitat. Considering this, it is important to ensure that their knowledge is available and utilized by management authorities.

The first comprehensive effort to document Nunavik Inuit Traditional Knowledge of polar bears, undertaken by the NMRWB, was published in 2018³⁸ and has provided resource managers access to this wealth of information. A similar effort has also been undertaken by the EMRWB to document Eeyou Istchee Cree knowledge of polar bears in the Eeyou Marine Region¹⁹¹. As is the case for scientific research, these traditional knowledge studies should also be regularly updated. The use of traditional knowledge to investigate targeted issues (e.g., identification of important habitat, behavioural studies, etc.) should also be promoted.

Approach 2.3: Improve our understanding of the changes to polar bear habitat, behaviour and interaction with other species and the potential impacts of these changes on polar bears.

The abundance, health and distribution of polar bears is influenced, to a large extent, by habitat quality and prey availability. A thorough understanding of these parameters and timely identification of information gaps is needed to implement effective management measures and a practical set of research priorities.

The effects of climate change on polar bears, within the management area, are not fully understood and merit further investigation if they are to be effectively considered in management decisions. Industrial development and increased shipping activities are also expected to affect polar bear habitat and baseline information towards understanding the impacts of such activities is needed.

It is also important to understand the evolving relationships between polar bears and the species they interact with. Monitoring the health, abundance and trends of seal populations is crucial since they are such an important component of the polar bear diet. Inuit communities have also raised significant concerns about the impacts that polar bears will exercise on migratory bird colonies and consequently, on the traditional practices that depend on them (e.g., harvesting eider down for use in clothing). Due to the northward expansion of black bear range, polar bears are encountering them more frequently and investigation into the potential consequences of these interactions is warranted.

Approach 2.4: Promote and encourage the training and meaningful involvement of Crees and Inuit in polar bear research and management.

As noted previously, Inuit and Cree possess substantial knowledge about polar bear ecology and should be encouraged to participate in the planning, execution and interpretation of research and monitoring programs. Doing so will require effective consultation with local hunters' associations, and greater collaboration, including efficient reporting and iterative feedback, between researchers and harvesters. Reaching a common understanding about research objectives and methods is paramount for both sides.

Because many Inuit and Crees spend a significant amount of time on the land, they are also in a unique position to make observations that relate to the ecology and habitat of polar bears, as well as instances of human-bear conflict. The Cree Nation Government and the Cree Trappers' Association have recently released a mobile application that can be used by the land users to compile details and location of any wildlife observation or harvest. A similar system, known as SIKU, is also used by the Nunavut Inuit. . Building local capacity and encouraging systematic monitoring activities and implementing similar processes in Nunavik communities could significantly bolster our understanding of polar bears, guide the establishment of research priorities and be later formalized into a community-based monitoring program.

Approach 2.5: Work towards improving non-invasive research methods and develop alternative means to collect biological information.

Given concerns raised by Inuit communities about the use of invasive research methods, there has been a shift away from such practices in recent years. As a result, abundance estimates are now conducted using aerial surveys or genetic mark-recapture surveys (i.e., biopsy darting); it will be important to refine these methods and explore new ones.

The use of less invasive research methods means that there is less opportunity for researchers to collect measurements and gather biological samples in the field. Alternative means of collecting such information are needed to ensure that the information can be used to estimate parameters such as reproductive success, cub survival, etc. The collection of biological samples by subsistence harvesters provides a unique opportunity to gather such information and can make important contributions to scientific research. In supporting the 1984 Anguvigaaq Polar Bear Regulations, the Gouvernement du Québec and Inuit agreed to establish a Québec-wide moratorium on drugging polar bears for scientific research. Because the position of Inuit has not changed with regards to the drugging and handling of polar bears, all parties should consider renewal and affirmation of this moratorium so that it is clear to all. Alternatively, and recognizing the valuable information that can be obtained from marking/collaring bears, it would be important that all parties agree on clear ground rules for the use of invasive research methods (e.g., identify an appropriate consultation process and determine necessary approvals).

Objective 3: Establishing strategies to minimize the effects of human activities on polar bears and their habitat, as well as to reduce human-bear conflicts.

Inuit and Cree have unanimously expressed major concerns about the growing threat posed by polar bears in this region. The number of bears entering communities and camps has increased and there are evident concerns for public safety, which must be addressed within this management plan.

On the other hand, it is also important to limit the negative impacts that human activities will have on polar bears. An increased human presence in the territory (due to tourism, industrial development, and shipping) can have detrimental effects on polar bears, their habitat and their prey.

Approach 3.1: Document all instances of human-bear conflicts.

Complete documentation of instances of human-bear conflict is necessary to provide management authorities with a full understanding of the issue. Given the frequency of such encounters, it is essential to promote public education and awareness about any reporting system that may be put in place. The proper reporting of all bears harvested in a defense of life and property situation will also be essential. This information will become useful to evaluate the effectiveness of deterrence and mitigation measures.

Approach 3.2: Develop programs and tools aimed towards reducing human-bear conflicts within the management plan area to increase public safety while reducing the number of Defense of Life and Property kills.

Public safety, due to the increased presence of polar bears, has become a major concern for many Inuit and Cree communities. Communities must be encouraged to develop plans to address these concerns and should be provided with the tools necessary to implement them. Such measures could include the establishment of polar bear patrols in high-risk areas, increased public education about bear safety, and public availability of polar bear deterrents. Regional means of addressing the issue (e.g., damage prevention/compensation programs) should also be explored.

Approach 3.3: Clarify the rights and obligations of Inuit, Cree and non-beneficiaries in respect to defense of life and property kills and provide clear guidance on the steps that must be followed when such circumstances arise.

The preservation of human life and property is clearly recognized in the Land Claims Agreements and a guiding principle of this management plan. It is important that this be clearly understood by anyone likely to encounter a polar bear.

That said, the NILCA and EMRLCA include provisions related to the take of polar bears in DLP which have yet to be fully implemented, particularly surrounding the disposal of valuable parts and reporting of polar bears killed in DLP. Clear and practical guidelines aimed at implementing these provisions and establishing a consistent process for dealing with DLP kills throughout the management plan area is needed.

Approach 3.4: Promote the respect and ethical treatment of polar bears by all users.

Polar bears are highly revered by the Inuit and occupy a large place in their culture and traditions. The Cree show a similar respect towards polar bear. For both peoples, it has always been extremely important to demonstrate the utmost respect for wildlife; a notion that remains deeply entrenched in

modern values. A number of ethical principles and traditional rules extend from this relationship with polar bears; it is important that everyone who visits Northern regions become sensitive to this reality and the fact that management actions also be guided by these values.

For example, Nunavik Inuit have raised serious concerns about the possibility of polar bear cubs being sent to zoos when they are orphaned. While many see this as an appropriate means of saving a polar bear cub, doing so is unethical from the perspective of Nunavik Inuit; the Cree of Eeyou Istchee share similar concerns. These concerns should be taken into account in cases when cubs are orphaned and a decision needs to be made.

Approach 3.5: Minimize the impacts of industrial development, shipping, tourism and other anthropogenic activities on polar bears within the management area.

There is a growing interest to develop economic ventures in the region, many of which can negatively impact polar bears. It is important to understand the scope of these activities and the threats they pose, as well as to identify approaches to minimize them.

For instance, there is a need to identify sensitive polar bear habitats for which particular protections and stewardship measures may be necessary, or which may require special consideration during the evaluation of potential development projects. Establishment of industry guidelines and best practices will also help to thwart possible detrimental impacts from these emerging activities.

The impacts of hydro-electric development on polar bears, their prey and the sea ice are a concern to Inuit and Cree. Given the region's existing hydroelectric infrastructure and its strong potential for new projects, it is important to gain a better understanding of implications, particularly the impacts on polar bears, their prey and the sea ice.

Objective 4: Collaborate, coordinate, communicate and promote the exchange of knowledge and information related to polar bears.

The exchange of knowledge and information will play a determining role in the effectiveness of this management plan and, generally, in the conservation of polar bears. Ambiguity with regards to rights and responsibilities will generate frustration and disagreements. Failure to transmit the knowledge of elders to the youth will create an immense gap in the local stewardship effort.

Approach 4.1: Foster the transmission of traditional knowledge between elders and youth.

The region's youth is expected to play an important role in the future management and stewardship of polar bears. Because lifestyles are changing rapidly, it is more important than ever that Inuit youth be taught the knowledge of their elders. A variety of approaches should be explored, such that the knowledge of elders, as it relates to polar bear, is available to the benefit of future generations of Inuit and Cree.

Approach 4.2: Strengthen the two-directional flow of information between community members, researchers, management authorities and other relevant stakeholders.

Gathering scientific knowledge and documenting traditional knowledge is not sufficient to ensure an effective and responsive polar bear management system. This is particularly true in a system founded upon both scientific information and traditional knowledge. To be truly effective, there must be clearly established channels of communication such that all parties are basing their decisions and positions on

the same information. Significant effort, from all parties, is needed to develop a communication strategy that addresses difficulties posed by language barriers, capacity issues and historical grievances.

Approach 4.3: Create a permanent forum wherein information and best practices related to polar bears can be discussed, and which will facilitate the coordination of polar bear management by the relevant parties.

The present management plan was born from a collaborative effort amongst all organizations with a role in polar bear management within the management plan area, via the Québec – Eeyou Marine Region – Nunavik Marine Region Polar Bear Working Group. This forum allowed close collaboration and candid exchanges between all parties and was a highly effective means of advancing this process. Maintaining this structure, or creating another that is similar in nature, will be a useful means of addressing many of the issues raised herein.

Approach 4.4: Enhance collaboration with other jurisdictions to guide polar bear management on a national and international level.

Management efforts within the region affect, and are affected by, activities and actions taken in neighbouring jurisdictions, nationally and internationally. Effective communication about the management system is necessary to ensure effective conservation of polar bears across their range. Participation by regional representatives to various forums, conferences and committees (i.e., PBAC, PBTC, Polar Bear Range States, CITES, etc.) aids towards this goal and should continue.

The effective management of the shared subpopulations discussed in this Management Plan requires significant inter-jurisdictional coordination and communication. For this to happen, it is essential that information be readily available to all parties and that harvesters from all relevant regions be afforded a forum to exchange their views about issues that will ultimately inform management decisions (e.g., status of polar bear subpopulations, management objectives, allocation of the harvest, etc.). Similarly, it is essential for management authorities (at all levels) to maintain frequent dialogue to ensure that there is alignment in their research and management priorities, in the population objectives upon which their management actions are founded and, importantly, in the timing of any decision-making processes for shared subpopulations. Whenever a decision is made that influences the total harvest within a subpopulation that is shared by multiple jurisdictions, prior discussion and coordination between decision-makers is useful to establish a common vision of the overall objectives sought and to ensure compatibility of the actions taken to achieve them. Finally, all parties should work collaboratively to identify and address any legislative, regulatory or policy gaps that stand in the way of the effective and efficient implementation of management actions.

10. Proposed Actions for the Management of Polar Bear in Québec, EMR and NMR

The following table presents the concrete actions that will provide a means of attaining the management objectives presented within this management plan. Because the Polar Bear Management Plan for Québec, the Eeyou Marine Region and the Nunavik Marine Region is the first comprehensive management plan for polar bears to ever be developed in the Management Plan Area, further dialogue with Nunavik Inuit and the Crees of Eeyou Istchee will be necessary to prioritize and implement management actions. Therefore, once the management plan has been approved by all relevant authorities, management partners will develop, in a timely manner, a companion document in which lays out a framework for action including an implementation table that sets out specific timelines for action to address the threats and information gaps according to subpopulations listed below. The table will provide the basis for an implementation agreement among management partners. The following actions will be implemented over the course of the management plan and may be updated as necessary to reflect any changes that occur.

Proposed Actions for the Management of Polar Bear in Quebec, the Eeyou Marine Region and the Nunavik Marine Region	
Objective #1: Establish a management system, based on the best available information, that reflects Inuit and Cree values and that can be adapted as necessary to ensure the long-term persistence of polar bears in the management plan area.	
Approach 1.1	<i>Review and, as appropriate, renew the 1984 Anguvigaaq Polar Bear Regulations and all commitments made therein.</i>
▪ Action 1.1.1	Review the commitments made under the 1984 Anguvigaaq Polar Bear Regulations and identify changes needed to align these commitments with present-day realities.
▪ Action 1.1.2	Formally recognize/adopt revised regulations, as relevant for each of the management partners and, where appropriate, have them enshrined in formal regulation by the responsible governments.
Approach 1.2	<i>Base polar bear management decisions upon the best available information.</i>
▪ Action 1.2.1	Develop clear policies and/or guidelines for the integration of Traditional Knowledge and Science in decision-making, to aid the creation of a fully representative management system.
▪ Action 1.2.2	Factor ecosystemic variables into polar bear management decisions (e.g., health and abundance of prey, impacts of climate change and anthropogenic activities, etc.).

▪ Action 1.2.3	Recognize the value of Inuit and Cree knowledge and their approaches to wildlife management and integrate those approaches with knowledge gained through scientific research during decision-making.
Approach 1.3	<i>Revise the harvest registration process with the goal of achieving complete reporting of all human-caused mortality of polar bears.</i>
▪ Action 1.3.1	Identify common obstacles encountered within the current registration process.
▪ Action 1.3.2	Identify most appropriate organization to administer/oversee harvest registration at the community level.
▪ Action 1.3.3	Establish clear protocol for harvest reporting and ensure all necessary implementation tools are in place.
▪ Action 1.3.4	Develop and implement a communications plan and public outreach tools that ensure familiarity with process and the importance of complete registration of the harvest.
▪ Action 1.3.5	Regularly assess effectiveness of the harvest registration system and identify necessary improvements, including implementation of regulatory mechanisms if voluntary reporting is ineffective.
Approach 1.4	<i>Implement a harvest management system that provides the tools necessary to achieve agreed-upon management objectives and long-term persistence of polar bear subpopulations; these can include mechanisms such as NQLs and TAT.</i>
▪ Action 1.4.1	For each subpopulation, review its status, identify management objectives and determine whether the current management system: a) is sufficient to ensure that harvesting is sustainable, in line with the principles of conservation and consistent with the management objectives; and b) does not unduly limit Inuit/Cree harvesting rights.
▪ Action 1.4.2	For subpopulations where the existing management system is deemed to be inadequate to address a conservation concern, or when it unduly restricts harvesting rights: a) amend the current management system as appropriate to address the issue identified; and b) ensure that communities are informed of the options, and allowed an opportunity to provide input; and

	c) initiate decision-making processes defined under the JBNQA, NILCA and EMRLCA, as necessary and make all attempts to ensure that management decisions are aligned with the processes occurring in neighboring jurisdictions.

Approach 1.5	<i>Annually review all pertinent information to inform adaptive management of polar bears.</i>
▪ Action 1.5.1	For each subpopulation, establish a forum where all relevant information can be shared amongst the management partners on a regular basis.
▪ Action 1.5.2	Annually review the information available for each subpopulation (e.g., harvest, abundance, health, DLP kills, etc.) and assess whether the existing management system is effective.
▪ Action 1.5.3	Make necessary changes to the management system (process is defined under Approach 1.4, above).
Approach 1.6	<i>Ensure, as appropriate, the protection of young bears and females.</i>
▪ Action 1.6.1	Maintain, using the most appropriate measures, the protection of young bears (e.g., local LNUK bylaw, formal government regulations, etc.).
▪ Action 1.6.2	Document the sex of all harvested polar bears (including bears killed in defense of life and property).
▪ Action 1.6.3	When there is a significant or sustained increase in the proportion of females killed, implement measures to lower the take of female bears (e.g., hunter education, etc.).
▪ Action 1.6.4	If necessary, develop and implement a regulatory framework that ensures sex-selective harvesting.
Approach 1.7	<i>Explore the implications and social acceptability of implementing a polar bear sport hunt and, as appropriate, identify the means by which such an activity could be established.</i>
▪ Action 1.7.1	Identify the obstacles, implications and potential benefits of a sport hunt (including experiences from other jurisdictions).
▪ Action 1.7.2	Obtain a clear mandate from Nunavik Inuit about whether to pursue the establishment of a sport hunt, after they have been given an opportunity to weigh all of the information.

▪ Action 1.7.3	If Nunavik Inuit are clearly in support of a sport hunt, undertake the necessary consultative processes with the Crees of Eeyou Istchee prior to developing and implementing a framework under which a sport hunt could be initiated.

Objective #2: Collect Traditional Knowledge and scientific information related to polar bears to inform management decisions.	
Approach 2.1	<i>Ensure coordination and collaboration towards monitoring the health and abundance of polar bears, at a frequency that allows robust decision-making.</i>
▪ Action 2.1.1	Maintain a collaborative effort to monitor polar bear health, abundance and trends through regular surveys.
▪ Action 2.1.2	Identify gaps and obstacles encountered in current and previous sampling programs and implement revisions that are practical, agreeable to hunters, and which allow collection of information that complements the data gathered during surveys.
▪ Action 2.1.3	Identify additional opportunities for community-based monitoring that can contribute to knowledge relevant for polar bear management.
▪ Action 2.1.4	Encourage the complementarity of research methods and priorities between regions, in collaboration with partners from other jurisdictions.
Approach 2.2	<i>Document the Traditional Knowledge of Nunavik Inuit and the Crees of Eeyou Istchee to inform research and guide management efforts.</i>
▪ Action 2.2.1	Ensure that the holders of Inuit Qaujimajatuqangit/Cree Knowledge are afforded a meaningful opportunity to provide input on polar bear management.
▪ Action 2.2.2	Identify and address the gaps in the extent of documented Inuit Qaujimajatuqangit/Cree Knowledge and in its availability to decision-makers (and re-assess periodically).

Approach 2.3	<i>Improve our understanding of the changes to polar bear habitat, behaviour and interaction with other species and the potential impacts of these changes on polar bears.</i>
▪ Action 2.3.1	Assess the availability of ecosystemic information relevant to the management of polar bear (i.e., habitat use, behaviour, prey, competitors, etc.) within the management plan area.
▪ Action 2.3.2	Establish research priorities that seek to address any identified knowledge gaps.
▪ Action 2.3.3	Gather the baseline information needed to better understand the potential impacts of future habitat alteration and increased human activity.
▪ Action 2.3.4	Seek to understand the evolving relationship between polar bears, their prey and the expansion or contraction of the range occupied by other species with which they may interact.
Approach 2.4	<i>Promote and encourage the training and meaningful involvement of Cree and Inuit in polar bear research and management.</i>
▪ Action 2.4.1	Encourage the participation of Inuit and Cree in the planning and interpretation of research and monitoring programs.
▪ Action 2.4.2	Build local capacity to undertake and actively participate in polar bear research, including the establishment of community-based monitoring and community-driven research programs.
▪ Action 2.4.3	Provide tools to facilitate the documentation of Inuit and Cree observations related to polar bear.
Approach 2.5	<i>Work towards improving non-invasive research methods and develop alternative means to collect biological information.</i>
▪ Action 2.5.1	Provide information to communities about polar bear research methods and best practices, including the pros and cons of invasive methods of research (e.g., what information is lost when researchers cannot handle/collar polar bears).
▪ Action 2.5.2	Obtain the Inuit and Cree positions with regards to the immobilization of polar bears.

▪ Action 2.5.3	Develop a clear protocol that defines the necessary steps and authorizations, whenever invasive research methods cannot be avoided (e.g., identify an appropriate consultation process).
▪ Action 2.5.4	Identify means of obtaining the necessary biological information that are non-invasive, or less invasive.

Objective #3: Establishing strategies to minimize the effects of human activities on polar bears and their habitat, as well as to reduce human-bear conflicts.

Approach 3.1	<i>Document all instances of human-bear conflicts.</i>
▪ Action 3.1.1	Put in place and maintain a standardized system to track all instances of polar bear – human conflict; regardless of whether a DLP kill occurs or not.
▪ Action 3.1.2	Ensure that Inuit and Cree communities are informed about this system and that there is local capacity to document this information.
▪ Action 3.1.3	Ensure that the information about polar bear – human interactions is flowing to decision-makers such that the information is considered when management measures are developed.
Approach 3.2	<i>Develop programs and tools aimed towards reducing human-bear conflicts within the management plan area to increase public safety while reducing the number of Defense of Life and Property kills.</i>
▪ Action 3.2.1	Where relevant, establish community polar bear response plans and support their implementation.
▪ Action 3.2.2	Put in place programs and tools to assist Cree/Inuit in dealing with dangerous bears (e.g., support polar bear patrols in high-risk areas, make polar bear deterrents available, etc.).
▪ Action 3.2.3	Increase public awareness about the danger of polar bears and share best practices on how to prevent interactions and/or deal with dangerous bears.

Approach 3.3	<i>Clarify the rights and obligations of Inuit, Cree and non-beneficiaries in respect to defense of life and property kills and provide clear guidance on the steps that must be followed when such circumstances arise.</i>
▪ Action 3.3.1	Develop a practical protocol for dealing with DLP kills in the management plan area, which reflects provisions of the NILCA and EMRLCA related to emergency kills and is consistent with the JBNQA.
▪ Action 3.3.2	Implement this protocol and ensure that it is effectively communicated throughout the region.
▪ Action 3.3.3	Ensure that Inuit, Cree and non-beneficiaries in the region are aware of their rights and obligations concerning DLP kills, and of other means to deal with problem bears.
Approach 3.4	<i>Promote the respect and ethical treatment of polar bears by all users.</i>
▪ Action 3.4.1	Reaffirm the engagement of all -management partners not to send polar bear cubs from the management area into zoos and aquariums.
▪ Action 3.4.2	Promote Inuit and Cree traditional values regarding polar bears to visitors and to local communities.
Approach 3.5	<i>Minimize the impacts of industrial development, shipping, tourism and other human activities on polar bears in the management area.</i>
▪ Action 3.5.1	Identify sensitive polar bear habitats for which protection and stewardship measures may be needed and ensure that this information is available to land use planners and during impact review processes.
▪ Action 3.5.2	Establish industry guidelines and best practices aimed at minimizing the detrimental effects caused by human activities.

Objective #4: Collaborate, coordinate, communicate and promote the exchange of knowledge and information related to polar bears.

Approach 4.1	<i>Foster the transmission of traditional knowledge between elders and youth.</i>

▪ Action 4.1.1	Develop approaches, such that the knowledge of elders related to polar bears is available to the benefit of future generations of Inuit and Crees (including knowledge about preparation and use of polar bear products).
▪ Action 4.1.2	Collaborate with the appropriate institutions towards developing educational materials that foster this exchange.
Approach 4.2	<i>Strengthen the two-directional flow of information between community members, researchers, management authorities and other relevant stakeholders.</i>
▪ Action 4.2.1	Promote the exchange of information between community members, researchers, management authorities and other relevant stakeholders (including with regards to rights and responsibilities) and ensure that these exchanges inform the National/International stage.
▪ Action 4.2.2	Encourage Crees/Inuit representation in scientific meetings.
▪ Action 4.2.3	Encourage researchers to visit Cree/Inuit communities, or to utilize local/regional events and communications tools (e.g., community radio) to inform Inuit and Crees about their research and findings.
▪ Action 4.2.4	Promote (to the scientific community, management authorities and relevant stakeholders) the value and importance of working collaboratively with Inuit and Crees on matters related to polar bear.
Approach 4.3	<i>Create a permanent forum wherein information and best practices related to polar bears can be discussed, and which will facilitate the coordination of polar bear management by the relevant parties.</i>
▪ Action 4.3.1	Formalize the Québec – Eeyou Marine Region – Nunavik Marine Region Polar Bear Working Group into a permanent committee and maintain its functionality.
▪ Action 4.3.2	Task the Working Group with development of an Implementation Plan that will give effect to the Actions proposed herein, and with the monitoring of its execution.
Approach 4.4	<i>Enhance collaboration with other jurisdictions to guide polar bear management on a national and international level.</i>
▪ Action 4.4.1	Recognizing extent of each jurisdiction's authority, maintain dialogue towards ensuring a coordinated polar bear management effort across jurisdictional boundaries.

▪ Action 4.4.2	Evaluate the effectiveness of current means for inter-jurisdictional coordination of polar bear management and, as appropriate, consider implementing structures to facilitate this exchange.
▪ Action 4.4.3	Ensure that management partners participate in provincial, national and international forums (e.g., PBAC, PBTC, Polar Bear Range States, CITES, etc.).

11. References

1. Committee on the Status of Endangered Wildlife in Canada. COSEWIC definitions and abbreviations. (2020). Available at: <http://cosewic.ca/index.php/en-ca/about-us/definitions-abbreviations#>. (Accessed: 15th October 2020)
2. Dyck, M. G. Characteristics of Polar Bears Killed in Defense of Life and Property in Nunavut, Canada, 1970-2000. *Ursus* **17**, 52–62 (2006).
3. *Eeyou Marine Region Land Claims Agreement*. (Minister of Public Works and Government Services Canada, 2011).
4. *James Bay and Northern Québec Agreement and Complementary Agreements*. (Les Publications du Québec).
5. *Nunavik Inuit Land Claims Agreement*. (Minister of Public Works and Government Services Canada, 2006).
6. Stephen, C. Toward a modernized definition of wildlife health. *J. Wildl. Dis.* **50**, 427–430 (2014).
7. Patyk, K. A. *et al.* Establishing a definition of polar bear (*Ursus maritimus*) health: A guide to research and management activities. *Sci. Total Environ.* **514**, 371–378 (2015).
8. Wenzel, G. W. From TEK to IQ: Inuit Qaujimajatuqangit and Inuit cultural ecology. *Arctic Anthropol.* **41**, 238–250 (2004).
9. Lévesque, F. Revisiting Inuit Qaujimajatuqangit: Inuit knowledge, culture, language, and values in Nunavut institutions since 1999. *Etudes Inuit Stud.* **38**, 115–136 (2014).
10. Warburton, H. & Martin, A. Local people's knowledge in natural resources research. (1999).
11. *The Convention on Biological Diversity of June 5 1992 (1760 U.N.T.S 69)*.
12. Smith, D. Foreword. in *Inuvialuit Settlement Region Traditional Knowledge Report, submitted by Inuvik Community Corporation, Tuktuuyaqtuuq Community Corporation and Aklavik Community Corporation. Submitted to Mackenzie Project Environmental Group, Calgary, Alberta.* (2006).
13. Linnaeus Carl. *Caroli Linnaei...Systema naturae per regna tria naturae :secundum classes, ordines, genera, species, cum characteribus, differentiis, synonymis, locis.* **v.1**, (Laurentii Salvii, 1758).
14. Gentry, A. The Authorship And Date Of The Specific Name Of *Ursus* Or *Thalarctos Maritimus*, The Polar Bear, Is Phipps (1774) And Not Linnaeus (1758). *Bull. Zool. Nomencl.* **58**, 2 (2001).
15. Phipps, C. J. *A Voyage Towards the North Pole Undertaken by his Majesty's Command*. (J. Nourse, 1773).
16. Kurtén, B. The evolution of the Polar Bear, *Ursus maritimus* Phipps. *Acta Zool. Fenn.* **108**, 1–30 (1964).
17. Thenius, E. Concerning the analysis of the teeth of polar bears. *Mammal. Bull.* **1**, 14–20 (1953).
18. Derocher, A. E. & Stirling, I. Temporal variation in reproduction and body mass of polar bears in western Hudson Bay. *Can. J. Zool.* **73**, 1657–1665 (1995).

19. Amstrup, S. C. Polar Bear. in *Wild mammals of North America: biology, management, and conservation* (eds. Feldhamer, G. A., Thompson, B. C. & Chapman, J. A.) 587–610 (John Hopkins University Press, 2003).
20. Demaster, D. P. & Stirling, I. *Ursus maritimus*. *Mamm. Species* **145**, 1–7 (1981).
21. Peacock, E., Taylor, M. K., Laake, J. & Stirling, I. Population ecology of polar bears in Davis Strait, Canada and Greenland. *J. Wildl. Manage.* **77**, 463–476 (2013).
22. Regehr, E. V., Lunn, N. J., Amstrup, S. C. & Stirling, I. A. N. Effects of earlier sea ice breakup on survival and population size of polar bears in western Hudson Bay. *J. Wildl. Manage.* **71**, 2673–2683 (2007).
23. Palmer, S. S., Nelson, R. A., Ramsay, M. A., Stirling, I. & Bahr, J. M. Annual changes in serum sex steroids in male and female black (*Ursus americanus*) and polar (*Ursus maritimus*) bears. *Biol. Reprod.* **38**, 1044–1050 (1988).
24. WIMSATT, W. A. Delayed implantation in the Ursidae, with particular reference to the black bear (*Ursus americanus* Pallas). in *Delayed implantation* (ed. Enders, A. C.) 49–86 (University of Chicago Press, 1963).
25. Ramsay, M. A. & Dunbrack, R. L. Physiological constraints on life history phenomena: the example of small bear cubs at birth. *Am. Nat.* 735–743 (1986).
26. McLoughlin, P. D., Taylor, M. & Dowsley, M. Update COSEWIC status report on the polar bear. *Prep. Comm. Status Endanger. Wildl. Canada. Iqaluit Gov. Nunavut, Dep. Environ.* (2008).
27. Rosing-Asvid, A., Born, E. & Kingsley, M. Age at sexual maturity of males and timing of the mating season of polar bears (*Ursus maritimus*) in Greenland. *Polar Biol.* **25**, 878–883 (2002).
28. Ramsay, M. a & Stirling, I. Reproductive biology and ecology of female polar bears (*Ursus maritimus*). *J. Zool. Soc. London* **214**, 601–634 (1988).
29. Derocher, A. E. & Stirling, I. Maternal investment and factors affecting offspring size in polar bears (*Ursus maritimus*). *J. Zool.* **245**, 253–260 (1998).
30. Saunders, B. L. The mating system of polar bears in the central Canadian Arctic. (Queen’s University, Kingston, Ontario, 2005).
31. Howell-Skalla, L. A., Cattet, M. R. L., Ramsay, M. A. & Bahr, J. M. Seasonal changes in testicular size and serum LH, prolactin and testosterone concentrations in male polar bears (*Ursus maritimus*). *Reproduction* **123**, 729–733 (2002).
32. Lunn, N. J. & Stenhouse, G. B. An observation of possible cannibalism by polar bears (*Ursus maritimus*). *Can. J. Zool.* **63**, 1516–1517 (1985).
33. Taylor, M. K., Larsen, T. & Schweinsburg, R. E. Observations of intraspecific aggression and cannibalism in polar bears (*Ursus maritimus*). *Arctic* **38**, 303–309 (1985).
34. Derocher, a. E. & Wiig, Ø. Infanticide and Cannibalism of Juvenile Polar Bears (<i>Ursus maritimus</i>) in Svalbard. *Arctic* **52**, 307–310 (1999).
35. Richardson, E. S. & Andriashek, D. Wolf (*Canis lupus*) predation of a polar bear (*Ursus maritimus*) cub on the sea ice off northwestern Banks Island, Northwest Territories, Canada. *Arctic* **59**, 322–324 (2006).
36. Thiemann, G. W., Iverson, S. J. & Stirling, I. Polar bear diets and arctic marine food webs: insights from fatty acid analysis. *Ecol. Monogr.* **78**, 591–613 (2008).

37. Galicia, M. P., Thiemann, G. W., Dyck, M. G. & Ferguson, S. H. Characterization of polar bear (*Ursus maritimus*) diets in the Canadian High Arctic. *Polar Biol.* **38**, 1983–1992 (2015).
38. Basterfield, M., Furgal, C., Breton-Honeyman, K., Rae, J. & O'Connor, M. *Nunavik Inuit Knowledge and Observations of Polar Bears: Polar bears of the Davis Strait sub-population. Report prepared for the Nunavik Marine Region Wildlife Board.* (2019).
39. Tarriasuk, Q. Personal Communication.
40. Watts, P. D. & Hansen, S. E. Cyclic starvation as a reproductive strategy in the polar bear. in *Symposia of the Zoological Society of London* **57**, 305–318 (Published for the Zoological Society by Academic Press., 1987).
41. Stirling, I. & Archibald, W. R. Aspects of Predation of Seals by Polar Bears. *J. Fish. Res. Board Canada* **34**, 1126–1129 (1977).
42. Rockwell, R. F. & Gormezano, L. J. The early bear gets the goose: climate change, polar bears and lesser snow geese in western Hudson Bay. *Polar Biol.* **32**, 539–547 (2009).
43. Stempniewicz, L. Polar bear predatory behaviour toward molting barnacle geese and nesting glaucous gulls on Spitsbergen. *Arctic* 247–251 (2006).
44. Derocher, A. E., Wiig, Ø. & Bangjord, G. Predation of Svalbard reindeer by polar bears. *Polar Biol.* **23**, 675–678 (2000).
45. Donaldson, G. M., Chapdelaine, G. & Andrews, J. D. Predation of thick-billed murres, *Uria lomvia*, at two breeding colonies by polar bears, *Ursus maritimus*, and walruses, *Odobenus rosmarus*. *Can. field-naturalist. Ottawa* **109**, 112–114 (1995).
46. Derocher, A. E., Andriashek, D. & Stirling, I. Terrestrial foraging by polar bears during the ice-free period in western Hudson Bay. *Arctic* 251–254 (1993).
47. Ovsyanikov, N. G. Interactions of polar bears with other large mammals, including man. *J. Wildl. Res.* **1**, 254–259 (1996).
48. Hobson, K. A., Stirling, I. & Andriashek, D. S. Isotopic homogeneity of breath CO₂ from fasting and berry-eating polar bears: implications for tracing reliance on terrestrial foods in a changing Arctic. *Can. J. Zool.* **87**, 50–55 (2009).
49. Hobson, K. A. & Stirling, I. Low variation in blood $\delta^{13}\text{C}$ among Hudson Bay polar bears: implications for metabolism and tracing terrestrial foraging. *Mar. Mammal Sci.* **13**, 359–367 (1997).
50. Dyck, M. G. & Romberg, S. Observations of a wild polar bear (*Ursus maritimus*) successfully fishing Arctic charr (*Salvelinus alpinus*) and Fourhorn sculpin (*Myoxocephalus quadricornis*). *Polar Biol.* **30**, 1625–1628 (2007).
51. Furnell, D. J. & Oolooyuk, D. Polar bear predation on ringed seals in ice-free water. *Canadian Field-Naturalist* **94**, 88–89 (1980).
52. Herreman, J. & Peacock, E. Polar bear use of a persistent food subsidy: Insights from non-invasive genetic sampling in Alaska. *Ursus* **24**, 148–163 (2013).
53. Lewis, A., Doidge, W. & Suppa, S. *Update of traditional knowledge on polar bears at Inukjuak and Puvirnituk, Nunavik. Report 12-493 submitted to Aboriginal Species at Risk Fund, Environment Canada, Québec Region.* (2006).

54. Harington, C. R. *Denning habits of the polar bear (Ursus maritimus Phipps)*. (Department of Indian Affairs and Northern Development, 1968).
55. Derocher, A. E., Stirling, I. & Andriashek, D. Pregnancy rates and serum progesterone levels of polar bears in western Hudson Bay. *Can. J. Zool.* **70**, 561–566 (1992).
56. Clark, D. A., Stirling, I. & Calvert, W. Distribution, characteristics, and use of earth dens and related excavations by polar bears on the western Hudson Bay lowlands. *Arctic* 158–166 (1997).
57. Brice-Bennett, C. Land use in the Nain and Hopedale regions. *Our Foot Prints Are Everywhere. Labrador Inuit Assoc. Ottawa* 97–204 (1977).
58. Stirling, I. & Andriashek, D. Terrestrial maternity denning of polar bears in the eastern Beaufort Sea area. *Arctic* 363–366 (1992).
59. Messier, F., Taylor, M. K. & Ramsay, M. A. Denning ecology of polar bears in the Canadian Arctic Archipelago. *J. Mammal.* **75**, 420–430 (1994).
60. Ferguson, S. H., Taylor, M. K., Rosing-Asvid, A., Born, E. W. & Messier, F. Relationships between denning of polar bears and conditions of sea ice. *J. Mammal.* **81**, 1118–1127 (2000).
61. Kalxdorff, S. B. *Collection of local knowledge regarding polar bear habitat use in Alaska*. (US Fish and Wildlife Service, 1997).
62. Van De Velde, F., Omi, Stirling, I. & Richardson, E. Polar bear (*Ursus maritimus*) denning in the area of the Simpson Peninsula, Nunavut. *Arctic* 191–197 (2003).
63. Kolenosky, G. B. & Prevett, J. P. Productivity and maternity denning of polar bears in Ontario. *Bears Their Biol. Manag.* 238–245 (1983).
64. Ramsay, M. A. & Stirling, I. Fidelity of female polar bears to winter-den sites. *J. Mammal.* **71**, 233–236 (1990).
65. Lunn, N. J., Stirling, I., Andriashek, D. & Richardson, E. Selection of maternity dens by female polar bears in western Hudson Bay, Canada and the effects of human disturbance. *Polar Biol.* **27**, 350–356 (2004).
66. Richardson, E., Stirling, I. & Hik, D. S. Polar bear (*Ursus maritimus*) maternity denning habitat in western Hudson Bay: a bottom-up approach to resource selection functions. *Can. J. Zool.* **83**, 860–870 (2005).
67. Wiig, Ø. *et al.* *Ursus maritimus*. The IUCN Red List of Threatened Species 2015. **8235**, (2015).
68. Taylor, M. & Lee, J. Distribution and abundance of Canadian polar bear populations: A management perspective. *Arctic* **48**, 147–154 (1995).
69. Taylor, M. K. *et al.* Delineating Canadian and Greenland polar bear (*Ursus maritimus*) populations by cluster analysis of movements. *Can. J. Zool.* **79**, 690–709 (2001).
70. Bethke, R., Taylor, M., Amstrup, S. & Messier, F. Population delineation of polar bears using satellite collar data. *Ecol. Appl.* 311–317 (1996).
71. Stirling, I., Calvert, W. & Cleator, H. Underwater vocalizations as a tool for studying the distribution and relative abundance of wintering pinnipeds in the High Arctic. *Arctic* 262–274 (1983).
72. Stirling, I. & Derocher, A. E. Possible impacts of climatic warming on polar bears. *Arctic* 240–245

- (1993).
73. Stirling, I., Andriashek, D. & Calvert, W. Habitat preferences of polar bears in the western Canadian Arctic in late winter and spring. *Polar Rec. (Gr. Brit.)* **29**, 13–24 (1993).
 74. Ferguson, S. H., Taylor, M. K. & Messier, F. Influence of sea ice dynamics on habitat selection by polar bears. *Ecology* **81**, 761–772 (2000).
 75. Kingsley, M. C. S., Stirling, I. & Calvert, W. The distribution and abundance of seals in the Canadian High Arctic, 1980–82. *Can. J. Fish. Aquat. Sci.* **42**, 1189–1210 (1985).
 76. Sahanatien, V. & Derocher, A. E. Monitoring sea ice habitat fragmentation for polar bear conservation. *Anim. Conserv.* **15**, 397–406 (2012).
 77. Obbard, M. E., Thiemann, G. W., Peacock, E. & DeBruyn, T. D. *Polar bears: Proceedings of the 15th working meeting of the IUCN/SSC Polar Bear Specialist Group, 29 June–3 July 2009, Copenhagen, Denmark. Occasional Paper of the IUCN Species Survival Commission* (2010).
 78. Reciprocal Arrangements Between Nunavik Inuit and the Inuit of Nunavut. in *Nunavik Inuit Land Claims Agreement* (2006).
 79. A consolidated Agreement Relating to the Cree/Inuit Offshore Overlapping Interests Area Between the Crees of Eeyou Istchee and the Nunavik Inuit (“The Cree/Inuit Overlap Agreement). in *Nunavik Inuit Land Claims Agreement* (2006).
 80. Nunavik Inuit Rights and Interests in the Labrador Inuit Settlement Area Portion of the Overlap Area. in *Nunavik Inuit Land Claims Agreement* (2006).
 81. *Species at Risk Act*. SC 2002, c 29
 82. COSEWIC. Available at: http://www.cosewic.gc.ca/eng/sct6/index_e.cfm. (Accessed: 2nd May 2016)
 83. Stirling, I. *COSEWIC status report on the polar bear Ursus maritimus in Canada*. (1986).
 84. Stirling, I. *Update COSEWIC status report on the polar bear Ursus maritimus in Canada*. (1991).
 85. Stirling, I. & Taylor, M. K. *Update COSEWIC status report on the polar bear Ursus maritimus in Canada*. (1999).
 86. COSEWIC. *COSEWIC assessment and update status report on the polar bear Ursus maritimus in Canada*. (2002).
 87. COSEWIC. *COSEWIC assessment and update status report on the polar bear Ursus maritimus in Canada*. (2008).
 88. *An Act Respecting Threatened or Vulnerable Species, RLRQ, c E-12.01, r2*.
 89. Québec, G. du. *Regulation respecting threatened or vulnerable wildlife species and their habitats*. (2016).
 90. *An Act Respecting Hunting and Fishing Rights in the James Bay and New Québec Territories, CQLR c D-13.1*.
 91. *An Act Respecting the Conservation and Development of Wildlife, CQLR c C-61.1*.
 92. *Regulation respecting trapping activities and the fur trade*.
 93. *Regulation respecting animals that must be declared*.
 94. *Wildlife Act, SNu 2003, c 26*.

95. *Harvesting Regulations, R-011-2015. Wildlife Act, SNu 2003, c 26.*
96. *Licenses and Tags Regulations, R-012-2015. Wildlife Act, SNu 2003, c 26.*
97. *Reporting Regulations, R-014-2015. Wildlife Act, SNu 2003, c 26.*
98. *Wildlife Transitional Regulations, 2015, R-022-2015. Wildlife Act, SNu 2003, c 26.*
99. *Wildlife Act, R.S.N.W.T. 1988, c.W-4.*
100. *Wild Animal and Plant Protection and Regulation of International and Interprovincial Trade Act, SC 1992, c 52.*
101. Polar Bear Range States. *Agreement on the Conservation of Polar Bears.* (1973).
102. Polar Bear Range States. *Circumpolar Action Plan: Conservation Strategy for Polar Bears. A product of the representatives of the parties to the 1973 Agreement on the Conservation of Polar Bears.* (2015).
103. Canada, G. of & Government of Quebec. *Cooperation Agreement for the Protection and Recovery of Species at Risk in Quebec.*
104. Hayeur, G. *Synthèse des connaissances environnementales acquises en milieux nordiques de 1970 à 2000.* (2001).
105. Prinsenberg, S. J. Man-Made Changes in the Freshwater Input Rates of Hudson and James Bays. *Can. J. Fish. Aquat. Sci.* **37**, 1101–1110 (1980).
106. LeBlond, P. H., Lazier, J. R. & Weaver, A. J. Can regulation of freshwater runoff in Hudson Bay affect the climate of the North Atlantic? *Arctic* **49**, 348–355 (1996).
107. Déry, S. J., Mlynowski, T. J., Hernández-Henríquez, M. A. & Straneo, F. Interannual variability and interdecadal trends in hudson bay streamflow. *J. Mar. Syst.* **88**, 341–351 (2011).
108. Milko, R. Potential ecological effects of the proposed Grand Canal Diversion project on Hudson and James bays. *Arctic* **39**, 316–326 (1986).
109. Prinsenberg, S. J. *Effects of Hydro-Electric Projects on Hudson Bay's Marine and Ice Environments.* (1994).
110. Gilbert, M. *et al. Hypothèses reliées aux effets environnementaux du projet Grande Baleine sur l'écosystème marin côtier du sud-est de la baie d'Hudson. Rapport technique canadien des sciences halieutiques et aquatiques 2127.* (1996).
111. Anctil, F. & Couture, R. Impacts cumulatifs du développement hydro-électrique sur le bilan d'eau douce de la baie d'Hudson. *Can. J. Civ. Eng.* **21**, 297–306 (1994).
112. Rosenberg, D. M., Bodaly, R. a. & Usher, P. J. Environmental and social impacts of large scale hydro-electric development: Who is listening? *Glob. Environ. Chang.* **5**, 127–148 (1995).
113. Fortier, L. *et al.* Impact of freshwater on a subarctic coastal ecosystem under seasonal sea ice (southeastern Hudson Bay, Canada). III. Feeding success of marine fish larvae. *J. Mar. Syst.* **7**, 251–265 (1996).
114. Short, F. T. *An Assessment of Hydro-Quebec data regarding eelgrass in James Bay, experimental studies on the effects on reduced salinity on eelgrass, and establishment of James Bay environmental monitoring by the Cree Nation. Report to the Cree Nation of Chisasibi.* (2008).
115. Basterfield, M., Furgal, C., Breton-Honeyman, K., Rae, J. & O'Connor, M. *Nunavik Inuit Knowledge*

- and Observations of Polar Bears: Polar bears of the Southern Hudson Bay sub-population. Report prepared for the Nunavik Marine Region Wildlife Board. (2018).*
116. Ministère de l'Énergie et des Ressources naturelles. *Rapport sur les activités minières au Québec 2014 DV 2015-01.* (2015).
 117. Gavrilchuk, K. & Lesage, V. *Large-scale marine development projects (mineral, oil and gas, infrastructure) proposed for Canada's North. Canadian Technical Report of Fisheries and Aquatic Sciences 3069.* (2014).
 118. Lawson, J. W. & Lesage, V. *A draft framework to quantify and cumulate risks of impacts from large development projects for marine mammal populations: A case study using shipping associated with the Mary River Iron Mine project. DFO Can. Sci. Advis. Sec. Res. Doc. 2012/154.* (Fisheries and Oceans Canada, Science, 2013).
 119. Southall, B. L. 'Shipping Noise and Marine Mammals : A Forum for Science , Management , and Technology'. in *Final Report of the National Oceanic and Atmospheric Administration (NOAA) International Symposium* 40 p. (2005).
 120. Arctic Council. *Arctic Marine Shipping Assessment 2009 Report.* (2009).
 121. ESL Environmental Services Limited. *The Biological Effects of Hydrocarbon Exploration and Production Related Activities Disturbances and Wastes on Marine Flora and Fauna of the Beaufort Sea Region.* doi:10.1017/CBO9781107415324.004
 122. DFO. *Science Review of Baffinland's Mary River Project Final Environmental Impact Statement.* (2012).
 123. Huntington, H. P. *et al.* Vessels, risks, and rules: Planning for safe shipping in Bering Strait. *Mar. Policy* **51**, 119–127 (2015).
 124. Harkonen, T. *et al.* Pup Production and Breeding Distribution of the Caspian Seal (*Phoca caspica*) in Relation to Human Impacts. *Ambio* **37**, 356–361 (2008).
 125. Wilson, S., Kasimbekov, Y., Ismailov, N. & Goodman, S. Response of mothers and pups of the Caspian seal, *Phoca caspica*, to the passage of icebreaker traffic. in *Proceedings of the Marine Mammals of the Holarctic, Odessa* 593–595 (2008).
 126. Oristland, N. A., Engelhardt, F. R., Juck, F. A., Hurst, R. J. & Watts., P. D. Effect of crude oil on polar bears. in *Environmental Studies No.24. Northern Affairs Program. Department of Indian and Northern Affairs Canada.* 268 p. (1981).
 127. Dyck, M. G. & Baydack, R. K. Vigilance behaviour of polar bears (*Ursus maritimus*) in the context of wildlife-viewing activities at Churchill, Manitoba, Canada. *Biol. Conserv.* **116**, 343–350 (2004).
 128. Clark, D. a, Beest, F. M. Van & Brook, R. K. Polar Bear-human conflicts: state of knowledge and research needs. *Can. Wildl. Biol. Manag.* **1**, 21–29 (2012).
 129. Letcher, R. *Temporal and spatial trends of legacy and emerging organic and metal/element contaminants in Canadian polar bears.* (2015).
 130. Jenssen, B. M. *et al.* Anthropogenic flank attack on polar bears: interacting consequences of climate warming and pollutant exposure. *Front. Ecol. Evol.* **3**, (2015).
 131. Kwan, M. & Chan, L. *Mercury inhibits neurochemical markers in the brain of polar bears (Ursus maritimus) in-vitro. Ecotoxicology of Mercury Session MS11-P10. The 10th International Conference on Mercury as a Global Pollutant.* (2011).

132. Krey, A., Kwan, M. & Chan, H. M. Mercury speciation in brain tissue of polar bears (*Ursus maritimus*) from the Canadian Arctic. *Environ. Res.* **114**, 24–30 (2012).
133. C. Fagre, A. *et al.* A Review of Infectious Agents in Polar Bears (*Ursus maritimus*) and Their Long-Term Ecological Relevance. *Ecohealth* **12**, 528–539 (2015).
134. Rah, H. *et al.* Serosurvey of selected zoonotic agents in polar bears (*Ursus maritimus*). *Vet. Rec. Ed.* **156**, 7–12 (2005).
135. Kirk, C. M., Amstrup, S., Swor, R., Holcomb, D. & O’Hara, T. M. Morbillivirus and *Toxoplasma* exposure and association with hematological parameters for southern Beaufort Sea polar bears: potential response to infectious agents in a sentinel species. *Ecohealth* **7**, 321–331 (2010).
136. Jensen, S. K., Aars, J., Lydersen, C., Kovacs, K. M. & Åsbakk, K. The prevalence of *Toxoplasma gondii* in polar bears and their marine mammal prey: evidence for a marine transmission pathway? *Polar Biol.* **33**, 599–606 (2010).
137. Taylor, M., Elkin, B., Maier, N. & Bradley, M. Observation of a polar bear with rabies. *J. Wildl. Dis.* **27**, 337–339 (1991).
138. Philippa, J. D. W. *et al.* Antibodies to selected pathogens in free-ranging terrestrial carnivores and marine mammals in Canada. *Vet. Rec.* **155**, 135–140 (2004).
139. Weber, D. S. *et al.* Low MHC variation in the polar bear: Implications in the face of Arctic warming? *Anim. Conserv.* **16**, 671–683 (2013).
140. Burek, K. A., Gulland, F. M. D. & O’Hara, T. M. Effects of Climate Change on Arctic Marine Mammal Health. *Ecol. Appl.* **18**, S126–S134 (2008).
141. Hueffer, K., O’Hara, T. M. & Follmann, E. H. Adaptation of mammalian host-pathogen interactions in a changing arctic environment. *Acta Vet. Scand.* **53**, 17 (2011).
142. Parkinson, A. J. & Butler, J. C. Potential impacts of climate change on infectious diseases in the Arctic. *Int. J. Circumpolar Health* **64**, 478–486 (2005).
143. Cavalieri, D. J. & Parkinson, C. L. Arctic sea ice variability and trends, 1979–2010. *Cryosphere* **6**, 881–889 (2012).
144. Gagnon, A. S. & Gough, W. A. Trends in the dates of ice freeze-up and breakup over Hudson Bay, Canada. *Arctic* **58**, 370–382 (2005).
145. Shepherd, T. G. Atmospheric circulation as a source of uncertainty in climate change projections. *Nat. Geosci.* **7**, 703–708 (2014).
146. Zhang, X. & Walsh, J. E. Toward a seasonally ice-covered Arctic Ocean: Scenarios from the IPCC AR4 model simulations. *J. Clim.* **19**, 1730–1747 (2006).
147. Stroeve, J., Holland, M. M., Meier, W., Scambos, T. & Serreze, M. Arctic sea ice decline: Faster than forecast. *Geophys. Res. Lett.* **34**, (2007).
148. Nickels, S., Furgal, C., Buell, M. & Moquin, H. Unikkaaqtigiit (Putting a human face on climate change). Perspectives from Inuit in Canada. (2010).
149. Atwood, T. C. *et al.* *Evaluating and Ranking Threats to the Long-Term Persistence of Polar Bears*. U.S. Geological Survey Open-File Report 2014-1254. (2015).
150. Hamilton, S. G. *et al.* Projected polar bear sea ice habitat in the Canadian Arctic Archipelago. *PLoS One* **9**, 1–7 (2014).

151. Amstrup, S. C. *et al.* Greenhouse gas mitigation can reduce sea-ice loss and increase polar bear persistence. *Nature* **468**, 955–958 (2010).
152. Hammill, M. O. Effects of Climate Warming on Arctic Marine Mammals in Hudson Bay: Living on the Edge? in *Responses of Arctic Marine Ecosystems to Climate Change* (eds. Mueter, F. J. *et al.*) 21–38 (Alaska Sea Grant, University of Alaska Fairbanks, 2013).
153. Derocher, A. E., Lunn, N. J. & Stirling, I. Polar Bears in a Warming Climate. *Integr. Comp. Biol.* **44**, 163–176 (2004).
154. Stirling, I. & Derocher, A. E. Effects of climate warming on polar bears: A review of the evidence. *Glob. Chang. Biol.* **18**, 2694–2706 (2012).
155. Ferguson, S. H., Taylor, M. K. & Mess. Influence of sea-ice dynamics on habitat selection by polar bears. *Ecology* **81**, 761–772 (2000).
156. Stirling, I. & Smith, T. G. Implications of warm temperatures and an unusual rain event for the survival of ringed seals on the coast of southeastern Baffin Island. *Arctic* 59–67 (2004).
157. Ramsay, M. A. & Hobson, K. A. Polar bears make little use of terrestrial food webs: evidence from stable-carbon isotope analysis. *Oecologia* **86**, 598–600 (1991).
158. Molnár, P. K., Derocher, A. E., Thiemann, G. W. & Lewis, M. A. Predicting survival, reproduction and abundance of polar bears under climate change. *Biol. Conserv.* **143**, 1612–1622 (2010).
159. Gormezano, L. J. & Rockwell, R. F. The Energetic Value of Land-Based Foods in Western Hudson Bay and Their Potential to Alleviate Energy Deficits of Starving Adult Male Polar Bears. *PLoS One* **10**, e0128520 (2015).
160. Dyck, M. G. & Kebreab, E. Estimating the energetic contribution of polar bear (*Ursus maritimus*) summer diets to the total energy budget. *J. Mammal.* **90**, 585–593 (2009).
161. Breton-honeyman, K., Furgal, C. M. & Hammill, M. O. Systematic Review and Critique of the Contributions of Traditional Ecological Knowledge of Beluga Whales in the Marine Mammal Literature. **69**, 37–46 (2016).
162. Davis, A. & Wagner, J. R. Who knows? On the importance of identifying ‘experts’ when researching local ecological knowledge. *Hum. Ecol.* **31**, 463–489 (2003).
163. Huntington, H. P. Observations on the utility of the semi-directive interview for documenting traditional ecological knowledge. *Arctic* **51**, 237–242 (1998).
164. Creswell, J. W. *Research Design*. SAGE Publications (2009). doi:10.4135/9781849208956
165. Tobias, T. *Living Proof: The Essential Data-Collection Guide for Indigenous Use-and-Occupancy Map Surveys*. (Union of British Columbia Indian Chiefs, 2010).
166. Gadamas, L. & Raymond-yakoubian, J. A Bering Strait Indigenous Framework for Resource Management : Respectful Seal and Walrus Hunting. **52**, 87–101 (2015).
167. Vongraven, D. *et al.* A circumpolar monitoring framework for polar bears. *URSUS* (2012).
168. Henri, D., Gilchrist, H. G. & Peacock, E. Understanding and managing wildlife in Hudson Bay under a changing climate: Some recent contributions from Inuit and Cree ecological knowledge. in *A Little Less Arctic* 267–289 (Springer, 2010).
169. Semple, H. A., Gorecki, D. K. J., Farley, S. D. & Ramsay, M. A. Pharmacokinetics and tissue residues of Telazol[®] in free-ranging polar bears. *J. Wildl. Dis.* **36**, 653–662 (2000).

170. Cattet, M. A CCWHC Technical Bulletin : Drug Residues in Wild Meat – Addressing A Public Health Concern. (2003).
171. Rode, K. D. *et al.* Effects of capturing and collaring on polar bears: Findings from long-term research on the southern Beaufort Sea population. *Wildl. Res.* **41**, 311–322 (2014).
172. Thiemann, G. W. *et al.* Effects of chemical immobilization on the movement rates of free-ranging polar bears. *J. Mammal.* **94**, 386–397 (2013).
173. Cattet, M., Boulanger, J., Stenhouse, G., Powell, R. A. & Reynolds-Hogland, M. J. an Evaluation of Long-Term Capture Effects in Ursids : Implications for Wildlife Welfare and Research. *J. Mammal.* **89**, 973–990 (2008).
174. Bechshoft, T. *et al.* Cortisol leveles in hair of east greenland polar bears. *Sci Total Env.* **409**, 831–834 (2012).
175. De Groot, P. V. C. *et al.* Toward a non-invasive inuit polar bear survey: Genetic data from polar bear hair snags. *Wildl. Soc. Bull.* **37**, 394–401 (2013).
176. Pagano, A. M., Peacock, E. & Mckinney, M. A. Remote biopsy darting and marking of polar bears. *Mar. Mammal Sci.* **30**, 169–183 (2014).
177. Stapleton, S., Garshelis, D., Peacock, E. & Atkinson, S. Foxe Basin Polar Bear Aerial Survey. 1–17 (2012).
178. Stapleton, S., Atkinson, S., Hedman, D. & Garshelis, D. Revisiting Western Hudson Bay: Using aerial surveys to update polar bear abundance in a sentinel population. *Biol. Conserv.* **170**, 38–47 (2014).
179. Breton-Honeyman, K., O’Connor, M. & Padlayat, A. *Community consultation on the management of beluga whales in Nunavik.* (2013).
180. Bonesteel, S. & Anderson, E. *Canada’s relationship with Inuit: A history of policy and program development.* (Indian and Northern Affairs Canada, 2008).
181. Régie régionale de la santé et des services sociaux Nunavik en collaboration avec l’Institut national de santé publique du Québec. *Portrait de santé du Nunavik 2011 : Conditions démographiques et socioéconomiques – Faits saillants.* (2011).
182. Duhaime, G., Fréchette, P. & Robichaud, V. *The economic structure of the Nunavik region (Canada): changes and stability.* (GETIC, Groupe d’études inuit et circumpolaires, Université Laval, 1999).
183. Duhaime, G. & Caron, A. *Indices comparatifs des prix du Nunavik: 2011.* (2012).
184. Duhaime, G. & Caron, A. *Consumer price monitoring in Nunavik 2011-2013.* (2013).
185. Iverson, S. A., Gilchrist, H. G., Smith, P. A., Gaston, A. J. & Forbes, M. R. Longer ice-free seasons increase the risk of nest depredation by polar bears for colonial breeding birds in the Canadian Arctic. *Proc. R. Soc. London B Biol. Sci.* **281**, 20133128 (2014).
186. Paetkau, D. *et al.* Genetic structure of the world’s polar bear populations. *Mol. Ecol.* **8**, 1571–1584 (1999).
187. Cronin, M. A., Amstrup, S. C. & Scribner, K. T. Microsatellite DNA and mitochondrial DNA variation in polar bears (*Ursus maritimus*) from the Beaufort and Chukchi seas, Alaska. *Can. J. Zool.* **84**, 655–660 (2006).
188. Crompton, A. E., Obbard, M. E., Petersen, S. D. & Wilson, P. J. Population genetic structure in polar bears (*Ursus maritimus*) from Hudson Bay, Canada: Implications of future climate change. *Biol.*

- Conserv.* **141**, 2528–2539 (2008).
189. Environment Canada. Conservation of Polar Bears in Canada. (2012). Available at: <https://www.ec.gc.ca/nature/default.asp?lang=En&n=A997D1CC-1>. (Accessed: 4th May 2016)
 190. Regehr, E. V, Wilson, R. R., Rode, K. D. & Runge, M. C. Resilience and risk: a demographic model to inform conservation planning for polar bears. (2015).
 191. Eeyou Marine Region Wildlife Board (EMRWB) 2020. Cree Knowledge of Polar Bears in the Eeyou Marine Region: A report based on information shared by Cree knowledge holders from the coastal communities of: Whapmagoostui, Chisasibi, Wemindji, Eastmain, and Waskaganish. 54 pp. (2020)

Part 7 – Management Plan for the Polar Bear (*Ursus maritimus*) in Newfoundland and Labrador

NOTE: The Management Plan for the Polar Bear in Newfoundland and Labrador will be adopted as Part 7 of the Federal Management Plan once it is transmitted to Environment and Climate Change Canada.