Inuvialuit Settlement Region
Polar Bear Joint Management Plan
2017

As recommended by:

WILDLIFE MANAGEMENT ADVISORY COUNCIL (NWT)

Wildlife Management Advisory Council North Slope

Inuvialuit Game Council

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.

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 l2(24)(*b*) and (*c*) and 14(6)(*b*) to (*d*), to be allocated the Total Allowable Harvest and to permit non-lnuvialuit 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 Qaujimajatuqangnit (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 qaujimajatuqangnit [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	*Species at Risk Act*
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

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 Act*s, *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.

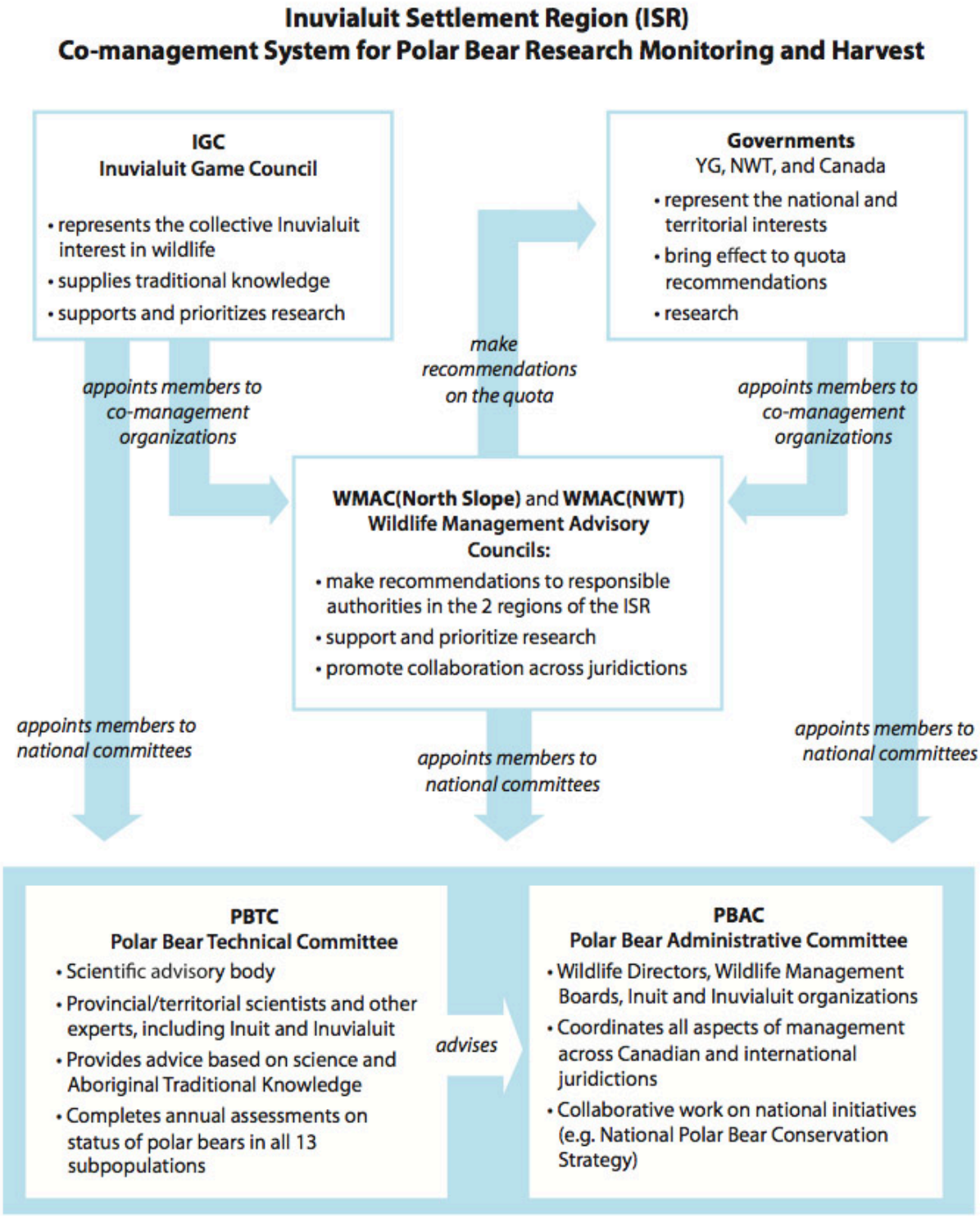

Figure 1. Illustration of joint management processes for polar bear research, monitoring and harvest in the ISR

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, HTCs, 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.nwtspeciesatrisk.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]

[1]Status assessments are independent biological assessments. Status in the NWT is assessed by SARC; status in Canada is assessed by COSEWIC.
[2]This 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.
[3] Information on the *Species at Risk (NWT) Act* and the SARC assessment is available at www.nwtspeciesatrisk.ca.
[4] Currently there is no Species at Risk legislation in place in Yukon.
[5]Information 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.

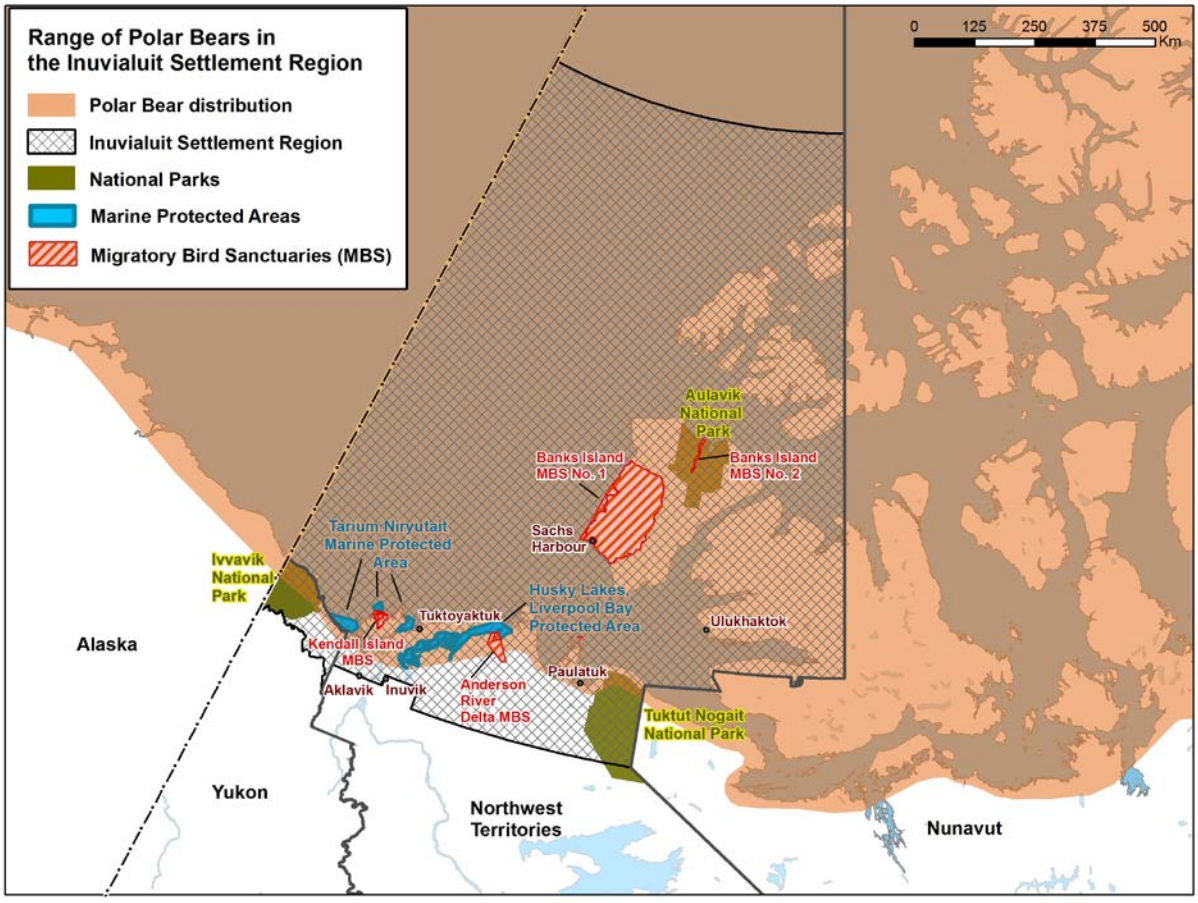

Figure 4. Range of polar bears in relation to the Inuvialuit Settlement Region.

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

[1]Based 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).

[2]Based 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).

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

[4]Though 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).

[5]Based 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.
[6]There is no known harvest taking place in the Arctic Basin within the ISR.
[7]User to user agreements in place.

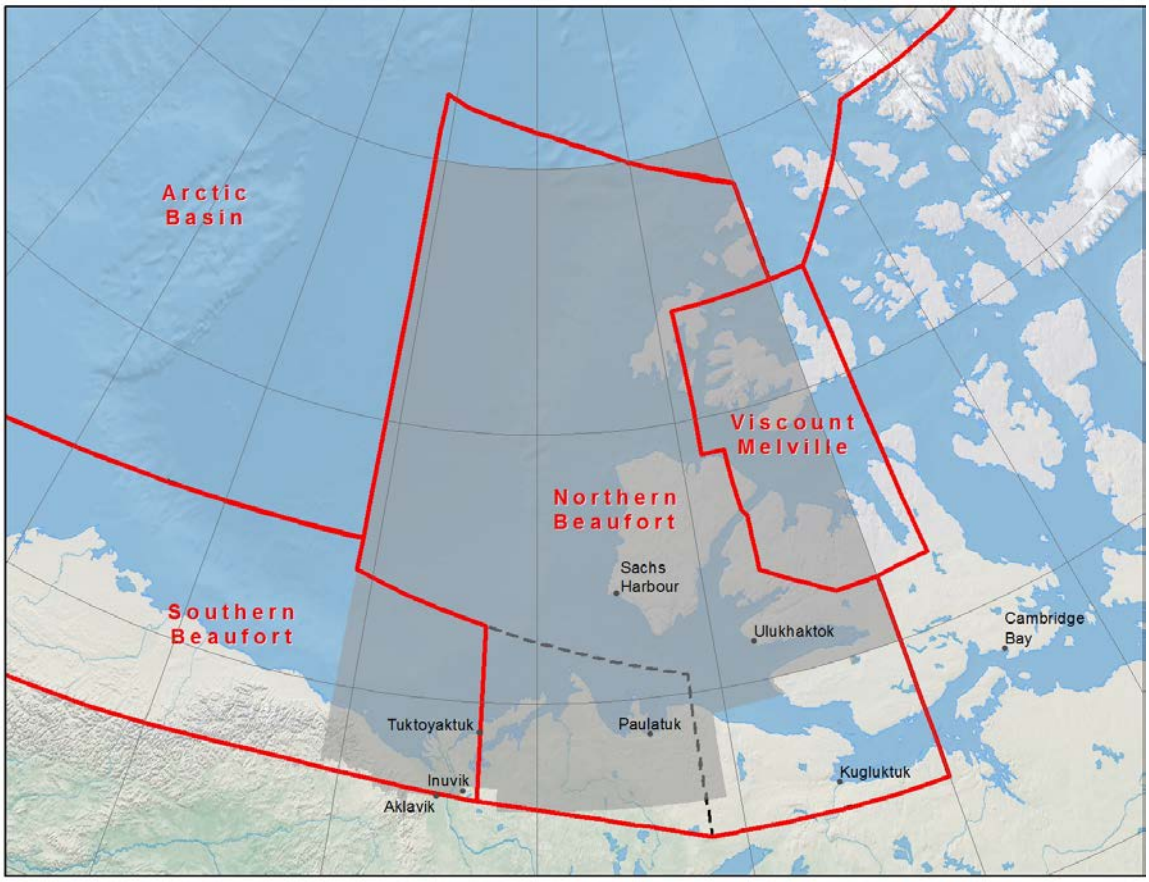

Figure 5. Subpopulation boundaries for polar bears in the ISR. New subpopulation boundaries as of 2013/2014 are shown as red lines; previous boundaries appear as dashed lines. The ISR is shown in light grey.

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 licences[2] 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, Nakaitchuq) (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 commissioners[3] 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, HTCs 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 HTCs are informed about polar bear management issues	Polar bear management documents/products provided to HTCs 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/mmm/polarbear/pdf/I-I%20Agreemnt%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. Estepp, 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. Ovsyanikov, E. Peacock, E. Richardson, V. Sahanatien, 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)

<u>Polar bears and climate change</u>
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 and1992 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 spill[4]	
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