Re-Assessment of the Southern Hudson Bay Polar Bear Subpopulation

Report to Southern Hudson Bay Polar Bear Subpopulation Advisory Committee from the Southern Hudson Bay Polar Bear Technical Working Group

Final; March 5, 2024

Credit: Félix Boulanger

Prepared by: Mark Basterfield (Nunavik Marine Region Wildlife Board); Alyssa Bohart (Nunavut Department of Environment); Félix Boulanger (Eeyou Marine Region Wildlife Board); Aurélie Bourbeau-Lemieux (Québec Ministère de l'Environnement, de la Lutte contre les changements climatiques, de la Faune et des Parcs); Melissa Galicia (coordinator; Environment and Climate Change Canada); Ezra Greene (Nunavut Tunnagvik Incorported); Rachel Guindon (Makivvik Corporation); Michael Ferguson (Qikiqtaaluk Wildlife Board); Barrie Ford (Makivvik Corporation); Nick Lunn (Environment and Climate Change Canada); Joseph Northrup (Ontario, Ministry of the Environment, Conservation and Parks and the Ministry of Natural Resources and Forestry); Alan Penn (Cree Nation Government); Kyle Ritchie (Nunavut Wildlife Management Board); Miles Smart (Hunting, Fishing and Trapping Coordinating Committee); Guillaume Szor (Québec Ministère de l'Environnement, de la Lutte contre les changements climatiques, de la Faune et des Parcs)

Edited by: Melissa Galicia (Environment and Climate Change Canada)

Table of Contents

Executive Summary

This executive summary is intended to provide to non-specialist audiences an overview of the Southern Hudson Bay Polar Bear Subpopulation Technical Working Group re-assessment report. Further details, including citations and methodological details are documented in the full report.

The Southern Hudson Bay (SH) polar bear subpopulation includes much of eastern and southern Hudson Bay and James Bay, as well as large expanses of coastal Ontario and Québec and islands located within the bays. Management authority for the SH subpopulation is a shared responsibility of federal, provincial, and territorial governments, wildlife management boards (WMBs) and similar entities, and land claims organizations that represent Indigenous rights holders. Regional and local Indigenous organizations and associations also play important roles as bodies that facilitate consultation, make management recommendations, and assist with the allocation and enforcement of harvest limits.

Current Status and Abundance

The current estimate of abundance for the SH subpopulation is 1119 polar bears (95% CI: 860–1454). The Canadian Polar Bear Technical Committee's (PBTC) 2023 assessment of the subpopulation was:

Status and trend assessment type	Short definition	Assessment result	Primary rationale
Historic Trend (Scientific)	Change in abundance since the signing of the *Agreement on the Conservation of Polar Bears* (1973)	Likely stable	Comparison of recent estimate of abundance (2011/2012, 2016, and 2021) to information collected in the 1980s and 1990s.
Trend (Indigenous Knowledge)	The abundance trend in a specific area over a defined period of time based on available Indigenous knowledge holders' experiences and observations	Stable in James Bay; Likely increased in east Hudson Bay	Interviews and consultations with Indigenous people describing changes over time in the number of polar bears observed, polar bear behavior, and other factors.
Most recent Trend (Scientific)	Changes in abundance over the last 15 years, according to western science methods	Likely stable	Comparison of the most recent estimate of abundance (2021) to the previous estimate collected in 2011/2012, as well consideration of evidence that Western Hudson Bay (WH) bears were present in the SH management zone during the 2021 survey and would have biased the abundance estimate upwards.

User-to-user meetings, which were held in 2011 and 2014, resulted in voluntary agreements to better manage polar harvest in the SH subpopulation (see Appendices A and B). Participants in these meetings included harvesters from affected communities, as well as representatives from the governments, wildlife management boards, and land claims organizations with co-management responsibility. Significant compromises were made by respective Indigenous rights holders.

The 2011 meeting, which was held in Inukjuak, Québec, was called in response to a high removal of polar bears by Inuit hunters during the 2010/2011 hunting season (105 polar bears, including 30 by Nunavut Inuit, 73 by Nunavik Inuit, and 1 by Eeyou Istchee Cree), and associated concern raised by domestic and international parties about the sustainability of harvest. The Inukjuak meeting resulted in a voluntary agreement that was in place for the 2011/2012 to 2013/2014 hunting seasons. The 2014 meeting, which was held in Ottawa, resulted in an updated voluntary agreement that was in place for the 2014/2015 and 2015/2016 hunting seasons.

The current harvest limits are as follows:

- Nunavut Settlement Area: 25 (Nunavut Inuit)
- Nunavik Marine Region: 23 (Nunavik Inuit, with at least one polar tag allocated to the Cree of Eeyou Istchee for harvest within the Inuit-Cree overlap area).

At present, there are no take limits in the Eeyou Marine Region south of the Inuit-Cree overlap area, which is also part of the Nunavik Marine Region, or in onshore areas of Québec. Under Treaty 9, there is no formal harvest limit for Ontario Cree; however, a voluntary limit of 30 bears per year that could be sealed for trade was established in 1976 through an informal agreement between the Ontario government and the coastal Cree First Nation communities. Since the listing of polar bear as a Threatened species under the Ontario Endangered Species Act in 2009, the sale of polar bear parts within Ontario has been prohibited.

In both the Nunavut Settlement Area and the Nunavik Marine Region, existing harvest limits were established assuming a sex selective harvest of two males for every female and a flexible quota system to adjust for over-harvest (subtract from base allocation the next year) or under-harvest (accumulation of credits for use in future years). Sex-selective harvesting was implemented to allow the maximum possible number of bears to be removed sustainably each year, recognizing that the removal of breeding-age female polar bears has a larger effect on population dynamics than the removal of male polar bears in most situations.

According to information provided to PBTC, the most recent 5-year (2017/18 – 2021/2022), 3-year (2019-2020 – 2021/2022), and current year (2021/2022) estimates of mean harvest in the subpopulation have been 40, 42.7, and 37 bears, respectively. These estimates correspond to a 4.7% to 5.5% removal rate relative to the 2016 subpopulation estimate of 780 polar bears. Harvest at a similar level moving forward would represent an annual removal of 3.3% to 3.8% of the current (2021) subpopulation estimate of 1119 polar bears.

In Nunavut, the Inuit community of Sanikiluaq is the only one that harvests within the SH subpopulation. Harvest reporting is believed to approach 100%. In Québec, there are three Nunavik Inuit communities (Inukjuak, Umiujaq, and Kuujjuaraapik) and five coastal Cree communities (Whapmagoostui, Waskaganish, Chisasibi, Wemindji, and Eastmain) that potentially harvest from this subpopulation. Although there is no legal requirement for beneficiaries of the James Bay and Northern Québec Agreement to report human-caused polar bear mortalities, the Québec Government has been compiling harvest reports and issuing tags since 1985. The proportion of the harvest reported to the Québec Government is currently unknown but is believed to be less than 100%. In Ontario, there are five coastal Cree communities that have traditionally harvested polar bears from the SH subpopulation (Fort Severn, Winisk (Peawanuk) Attawapiskat, Fort Albany, and Kashechewan), and one community (Moosonee/Moose Factory) that has occasionally reported defense of life and property kills. The proportion of the harvest that is reported to the Government of Ontario is currently unknown.

Over the past ten years, the following harvest limits have been in place and the following harvest levels (H) reported to wildlife management officials:

Hunting season	Nunavut†		Québec‡		Ontario	
	Limit	H	Limit	H	Limit	H
2012/2013	TAH = 25	26	VA = 30	33	None[a]	2
2013/2014	TAH = 25	27	VA = 30	11	None[a]	0
2014/2015	VA = 20	20	VA = 23	22	None[b]	1
2015/2016	VA= 20	20	VA = 22	19	None[b]	2
2016/2017	TAH = 25	22	TAT=23	7	None	2
2017/2018	TAH = 25	28	TAT=23	5	None	0
2018/2019	TAH = 25	23	TAT[c]=23	11	None	5
2019/2020	TAH = 25	23	TAT[c]=23	7	None	5
2020/2021	TAH = 47	47	TAT[c]=23	7	None	1
2021/2022	TAH = 31	31	TAT[c]=23	6	None	0

TAH: Total Allowable Harvest; TAT: Total Allowable Take; VA: harvest limit determined by voluntary agreement among users. See full report for details about harvest limits, as well as areas where limits have been in place.

[a]A voluntary limit of 5 bears was agreed upon by the coastal Cree communities of Ontario in attendance at the 2011 Inukjuak meeting, however not all communities were present.

[b]A voluntary limit of 3 bears to be split between Ontario and Québec Cree, with alternating division per season starting with 2 for Ontario Cree in 2014/2015 was agreed upon by the coastal Cree communities of Ontario in attendance at the 2014 Ottawa meeting, however not all communities were present.

[c] The TAT that has been in place since 2016/2017 applies only to the Nunavik Marine Region, including the "Inuit Zone" and the "Joint Inuit/Cree Zone" but excluding the "Cree Zone" of the Inuit/Cree Offshore Overlapping Interests Area. There is no TAT in force on the remaining portion of the Eeyou Marine Region nor on the mainland of Québec.

Indigenous Knowledge

In 2018, the Nunavik Marine Region Wildlife Management Board completed a comprehensive polar bear Inuit knowledge (IK) study. Key findings included: (a) an increase in the number of polar bears observed by Nunavik Inuit since the 1970s; (b) a wider distribution of polar bears, including the use of inland areas; and (c) polar bear condition described as very healthy. With regard to management, a frequently expressed view was that traditional stewardship practices are sufficient for conservation and that the introduction of a quota to limit polar bear hunting is unnecessary. Common stewardship practices include hunting only based on need and not wasting any of the animal killed, not hunting polar bears during the summer, and not harvesting cubs or known mothers.

Nunavut Inuit Qaujimajatuqangit (IQ), shared by community members from Sanikiluaq at the November 2018 Nunavut Wildlife Management Board public hearing to consider the Nunavut Polar Bear Co-Management Plan, emphasized that the polar bear population is increasing rather than decreasing in Nunavut, including in the area around Sanikiluaq. Participants also stated that climate change will not cause the disappearance of polar bears. According to IQ, it is normal for the polar bear population to increase and decrease in a cycle.

A study documenting the knowledge of Cree land users, in the Eeyou Marine Region, conducted by the Cree Nation Government, Eeyou Marine Region Wildlife Board and Cree Trappers' Association was completed in 2020. Main results include expressions of concern about an increase in the relative abundance of polar bears in the Eeyou Marine Region and a growing number of human-polar bear interactions. Climate change, and more specifically changes in sea ice dynamics in Hudson Bay and James Bay, were mentioned as potential causes for the observed changes.

Scientific Assessment

Results from two capture-recapture studies conducted mainly along the Ontario coastline of Hudson Bay suggest that polar bear abundance was largely unchanged between 1984–1986 and 2003–2005. Following an analysis of bears captured on Akimiski Island in James Bay during 1997 and 1998, the total SH subpopulation was estimated by the PBTC to number between 900-1000 bears for management purposes.

Aerial surveys, conducted in 2011/2012 and 2016, resulted in estimates of abundance of 943 polar bears (95% CI: 658–1350) and 780 polar bears (95% CI: 590–1029), respectively. This change equates to a 17% decline in abundance. Although the 95% confidence intervals for the two estimates overlap, an 18% decline in point estimates of abundance was noted over the same time period in the neighbouring Western Hudson Bay (WH) polar bear subpopulation. The simultaneous declines in SH and WH were cited by PBTC as an additional line of evidence to suggest that polar bear numbers in the SH subpopulation had likely declined. Estimates of the proportion of yearling polar bears in the SH subpopulation also declined, from 12% in 2011 to 5% in 2016, whereas the proportion of cubs remained similar (16% in 2012 vs. 19% in 2016). These results suggest there was low survival of cubs to the yearling age class in 2015. A supplementary

aerial survey, conducted in 2018, covering a high-density portion of the subpopulation (Ontario coastline and Akimiski Island), was used to examine whether the 2016 study results were indicative of a trend. Results demonstrated variable yearling proportions and a slightly lower abundance of bears in re-surveyed portions of the coastal area in 2018 (249 bears, 95% CI: 230 – 270) compared with 2016 (269 bears, 95% CI: 244 – 297) and significantly lower abundance than in 2011 (422 bears, 95% CI: 381 – 467).

A comprehensive aerial survey was conducted in August and September 2021 to provide a third estimate of the abundance of the SH subpopulation. Field methods were nearly identical to the 2011/12 and 2016 surveys. Recent advancements in distance sampling statistical modeling were applied to obtain a more robust estimate of the subpopulation abundance. However, this estimate was not directly comparable to the 2016 estimate. The 2021 aerial survey produced two separate estimates: 1) 1003 (95% CI 773-1302), which is directly comparable to the previous 2016 survey abundance estimate and 2) 1119 (95% CI 860-1454), which provided a more robust estimate using recent advances in statistical methods. The most comparable estimate to the 2016 survey indicated a 29% increase in the number of bears in the subpopulation at the time of the survey. In addition, reproduction appeared to be robust with 18% of the observed bears being cubs and 18% being yearlings. Two main biological drivers are likely to have contributed to the greater number of bears observed within SH in 2021 relative to 2016: annual variation in the on-land distribution of bears in SH and the neighbouring WH subpopulation, and improved demographic rates. It is likely that both drivers have contributed to the observed differences in abundance, to varying degrees, although there is no definitive evidence to support either driver.

In addition to studies assessing polar bear abundance, considerable research has been conducted to evaluate changes in polar bear body condition, survival rates and reproduction. With respect to body condition, the Ontario Ministry of Natural Resources and Forestry examined trends for 900 bears captured on shore during the ice-free period in 1984-1986, 2000-2005, and 2007-2009. A body condition index (BCI), based upon measurements of a bear's mass relative to body length, indicated a decline in condition for all age, sex and reproductive classes. In Nunavut, body condition scores (BCS) of harvested bears have been reported for the SH bears since 2010. The BCS of 191 hunter-harvested polar bears was examined between 2010 and 2017. Bears included in the Nunavut study were primarily taken on the sea ice during winter and spring. 92.7% had a BCS of average and better, while 7.3% were deemed skinny or very skinny.

The most up-to-date estimates of survival in the SH subpopulation, which are based upon capture-recapture data collected from 1984 through 2005, indicate substantial declines in survival among all age and sex classes since the 1980s.

Analysis of bear movement data, from radio-collared and hunter-harvested bears, indicate that most bears remain within the currently recognized SH subpopulation boundary, although regular movements into adjoining subpopulations in WH and Foxe Basin (FB) occur, primarily during the on-ice period. During the ice-free period, bears demonstrate a high degree of fidelity to onshore areas, though depending on the patterns of ice breakup, SH bears occasionally come ashore in WH. Further, preliminary analysis of data on marked bears that are subsequently harvested suggests that up to 10% of the bears harvested in SH were previously marked in WH. Small

mating season home ranges, combined with geographic isolation, is believed to have contributed to potential genetic distinctiveness among polar bears in James Bay compared to other locations across the Arctic.

Finally, a study using a standardized methodology to document trends in sea ice habitat for all 19 global polar bear subpopulations (1979-2014), found that all 19 subpopulations have experienced earlier spring sea ice retreat, later fall sea ice formation, and reduced summer sea ice areas of coverage over the last four decades. Relative to other polar bear subpopulations, the SH subpopulation, which is the most southerly of all global subpopulations, has one of the shortest duration ice seasons (approximately 210 days above the 15% sea ice coverage threshold used by the authors). While the rate of sea ice loss in the SH subpopulation has been extensive (change in spring ice retreat: -3.1 days per decade; change in fall ice advance: +4.1 days per decade; change in summer sea ice area: -11.4% per decade), the rate of loss has been less extreme than in some other subpopulations.

1. Background

1.1. Southern Hudson Bay Polar Bear Subpopulation Boundary

The boundary of the Southern Hudson Bay (SH) polar bear subpopulation was established based on observed movements of marked and collared polar bears (Jonkel et al. 1976, Kolenosky and Prevett 1983, Kolenosky et al. 1992, Obbard and Middel 2012, Middel 2013). It includes much of eastern and southern Hudson Bay and James Bay, as well as large expanses of coastal Ontario and Québec up to 120 km inland and islands located within the bays (Kolenosky and Prevett 1983, Obbard and Walton 2004, Obbard and Middel 2012) (Figure 1).

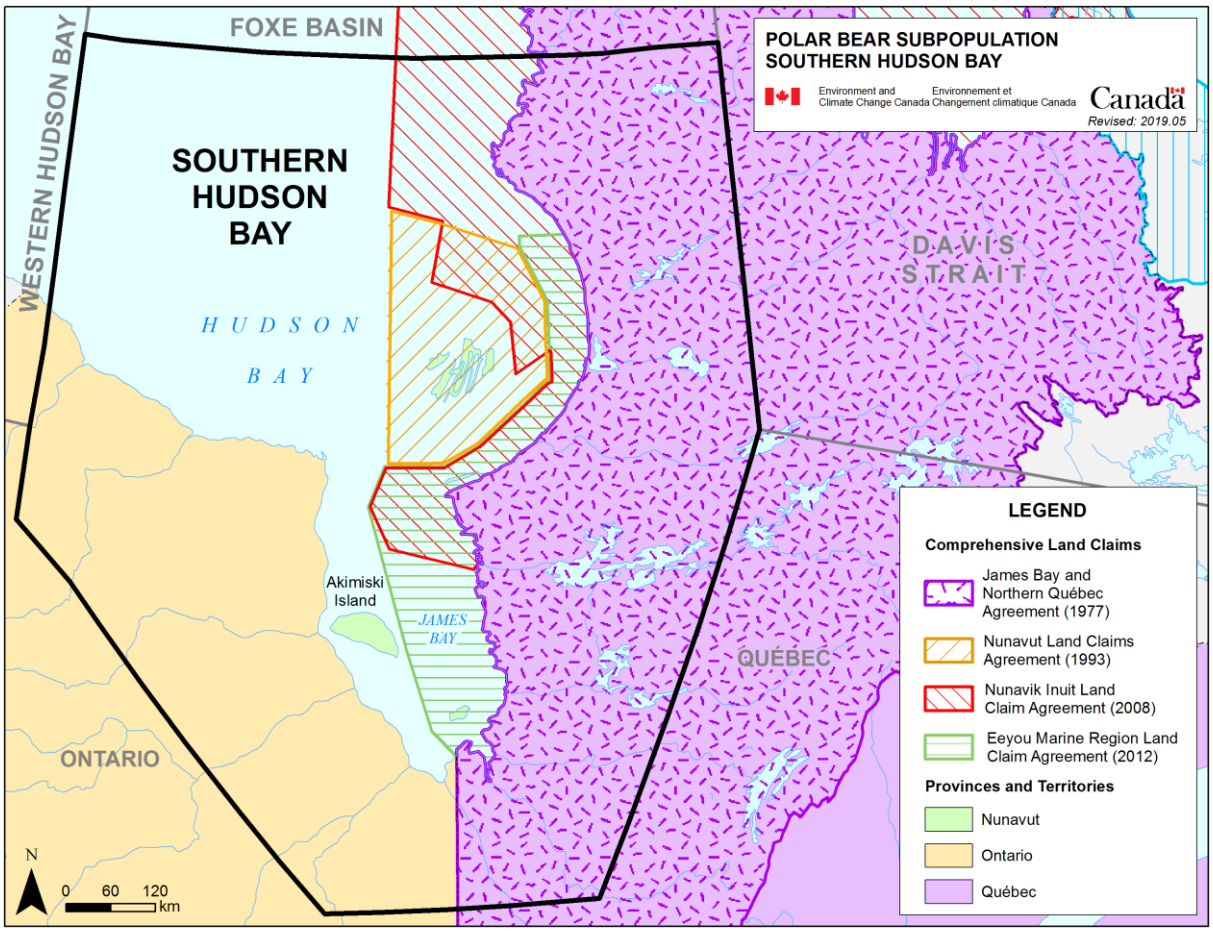

***Figure 1**. Southern Hudson Bay Polar Bear Subpopulation boundary and associated land claim areas, and provincial and territorial boundaries.*

1.2. Management Authority

Management authority for SH subpopulation polar bear is a shared responsibility of federal, provincial and territorial governments, wildlife management boards (WMBs)/similar entities, and land claims organizations that represent Indigenous rights holders. Regional and local Indigenous organizations and associations also play important roles as bodies that facilitate consultation, make management recommendations, and assist with the allocation and enforcement of harvest limits.

Table 1 lists the organizations with management responsibility in Southern Hudson Bay, as well as the treaties and land claims agreements from which mandates are derived. In locations where WMBs have been established WMB decisions for Total Allowable Take (TAT) / Total Allowable Harvest (TAH) of polar bear are forwarded to government Ministers, who have the authority to accept or reject initial board decisions, and to accept, reject or vary final decisions of the boards. Ministers also have the responsibility to implement final decisions. The Hunting, Fishing and Trapping Coordinating Committee (HFTCC) is not a decisional body for polar bear but can recommend a TAT to the Québec government Minister, who has the discretion to act upon such recommendation, in accordance with the required consultations.

***Table 1**. Management partners involved in polar bear harvest decision-making for the Southern Hudson Bay polar pear subpopulation and their current decision-making relationships.*

Agreement or Treaty	Area of Application	Wildlife Management Board or Similar Entity	Government Authority	Land Claims Organization
Nunavik Inuit Land Claims Agreement (NILCA)[1,2]	Nunavik Marine Region	Nunavik Marine Region Wildlife Management Board (NMRWB)	Canada (offshore) Nunavut (islands)	Makivvik Corporation
Nunavut Agreement	Nunavut Settlement Area	Nunavut Wildlife Management Board (NWMB)	Nunavut	Nunavut Tunngavik Inc.
Eeyou Marine Region Land Claims Agreement (EMRLCA)[2]	Eeyou Marine Region	Eeyou Marine Region Wildlife Management Board (EMRWB)	Canada (offshore) Nunavut (Islands)	Cree Nation Government
James Bay and Northern Québec Agreement (JBNQA)	Mainland of Québec	Hunting, Fishing and Trapping Coordinating Committee (HFTCC)	Québec	Makivvik Corporation Cree Nation Government
Treaty 9	Mainland of Ontario	Not applicable	Ontario	Individual Cree First Nations, Muschkegowuk Council

[1] A reciprocal arrangement between Nunavik Inuit and Nunavut Inuit identifies Areas of Equal Use and Occupancy (AEUO) within the Nunavik Marine Region. Within the boundaries of the Southern Hudson Bay Polar Bear Subpopulation, one such AEUO encompasses islands situated between Umiujaq, QC and Sanikiluaq, NU. Until a formal process to govern wildlife management within the AEUO is established the NWMB retains exclusive jurisdiction over this area but the NWMB's membership is varied to allow for Nunavik Inuit representation through the appointment of members by Makivvik (NILCA Part 27.6).

[2] The NILCA and EMRLCA incorporate an overlap agreement that specifies three zones: a Cree Zone, a Joint Zone, and an Inuit Zone. Throughout the overlap area, the Nunavik Inuit and the Crees of Eeyou Istchee have the same rights respecting the harvest of wildlife. For the Inuit Zone, the NMRWB maintains wildlife management responsibilities, but a Cree Nation Government observer is entitled to replace a Makivvik appointed board member during any vote. For the Joint Zone, wildlife management decisions are to be made jointly and equally by the NMRWB and EMRWB. Within the Cree Zone, the EMRWB maintains wildlife management responsibilities, but a Makivvik appointed observer is entitled to replace a Cree board member during any vote.

2. Canada's Polar Bear Technical Committee Assessment of Status and Trend

The Polar Bear Technical Committee (PBTC) is composed of individuals who have scientific or Indigenous knowledge (IK) of polar bear biology and habitat and are appointed by the jurisdictions, management boards, or agencies that have legal responsibility for polar bear management in Canada. The PBTC meets annually to review scientific and IK necessary to meet defined management needs in support of Canada's national and international conservation responsibilities under the 1973 *Agreement on the Conservation of Polar Bears*. The PBTC helps facilitate coordination of research activities among Canadian jurisdictions that have polar bears, as well as the United States and Greenland for those subpopulations that are shared between Canada and these jurisdictions. The PBTC provides technical advice and recommendations to the Polar Bear Administrative Committee (PBAC), as required, on (1) design, collaboration, and conduct of polar bear research in Canada; (2) harvest and population trends; and (3) the need for management actions.

One of the key outputs of the PBTC is an annual status assessment report on Canadian polar bear subpopulations, including harvest, based on scientific information and IK provided by member agencies.

2.1 Most Recent PBTC Status Assessment (2023)

The most recent status assessment of the SH subpopulation by the PBTC was based on presentations and discussions of the results of the 2021 aerial survey (Northrup et al. 2022) at the Committee's 2023 meeting held in Québec City, January 31st to February 2nd, and videoconference on May 11th, 2023. Although the Northrup et al. (2022) report presented two separate estimates of abundance and identified the potential temporary emigration of Western Hudson Bay bears into the SH management zone at the time the surveys were flown, the PBTC accepted the more robust estimate of 1,119 bears (95% CI: 860-1454) derived from a novel approach to estimating the probability of detection on the transect line while accounting for the blind spot affecting rear observers (Wiig et al. 2022).

<u>Trends in Subpopulation Abundance</u>

Historical trend is an assessment of change in abundance that a subpopulation may have experienced since the signing of the 1973 *Agreement on the Conservation of Polar Bears* (1973), which led to current management practices and research, to the present estimate. The PBTC recognized that a rigorous assessment of trends in abundance of SH is complicated due to differences in the design and geographic extent of previous capture-recapture and aerial survey studies, definition of the study population, and lack of recent movement data to both quantify and evaluate impacts of temporary immigration/emigration. The PBTC assessment of historical trend was based on earlier subpopulation estimates conducted in the 1980s and 1990s (Kolenosky et al. 1992, Obbard et al. 2007, Obbard 2008) and the 2011/2012 and 2021 aerial surveys (Obbard et al. 2015, Northrup et al. 2022). As these estimates are broadly similar but

not directly comparable, the PBTC inferred stability and qualified its assessment of historical trend in abundance of the SH subpopulation to be "likely stable".

The PBTC assessed the recent trend in abundance to be "likely stable". This is an assessment of change in abundance over the past 15 years, focusing on the results of the 2011/2012 aerial survey (Obbard et al. 2015), the 2021 aerial survey (Northrup et al. 2022), and consideration of evidence that WH bears were present in the SH management zone during the 2021 survey and would have biased the abundance estimate upwards (Northrup et al. 2022).

The PBTC's IK assessment of the SH subpopulation is that it is "stable" in James Bay and "likely increased" in east Hudson Bay. The assessment was based upon information from a number of sources, including a recently completed report by the Nunavik Marine Region Wildlife Board; NMRWB (NMRWB 2018).

Trends in Harvest

Due to differences in the harvest management systems in Nunavut, Ontario, and Québec, it is not possible to determine an exact number of the potential, annual allowable removal from the subpopulation. The most recent 5-year (2017/18 – 2021/22) mean and current year (2021/22) harvest levels have been reported as 39.8 and 37 bears, respectively. These removal levels correspond to removal rates equating to 4.7% to 5.1% of the 2016 estimate of subpopulation abundance. Harvest at similar levels moving forward would represent an annual removal rate of 3.3% to 3.6% of the current subpopulation estimate.

2.2 Previous PBTC Assessments

Over the past 25 years, the PBTC has made changes to both the content and methods used in the assessment and presentation of subpopulation status. Thus, it is not practical to make direct comparisons of the annual status assessments. However, there is consistent content that can be compared. From 1998-2017, the PBTC has used varying numbers between 900 and 1000 bears as the estimate of abundance for the SH subpopulation (e.g., 900, 943, 951, 900-1000, 1000). All were based on scientific studies (Kolenosky et al. 1992, Obbard et al. 2007, Obbard 2008, Obbard et al. 2015), although some of the earlier estimates were subsequently adjusted upwards, based on professional judgement, for management purposes to account for unsurveyed areas (James Bay, Québec coastal areas). Over this time, both historic and recent trends, when assessed, were considered to be stable.

Following the release of the results of the 2016 SH aerial survey (780 bears, 95% CI: 590-1029, Obbard et al. 2018), the PBTC assessed the recent trend in abundance to be "likely declined" based on a 17% decline in point estimates of abundance from the 2011-2012 aerial survey (943 bears, 95% CI: 658–1350, Obbard et al. 2015). A similar decline in abundance of the WH subpopulation (18% decline), over the same time period (Dyck et al. 2017), was considered an additional line of evidence suggesting a larger ecosystem change may be occurring. As a result, the PBTC changed its 2018 assessment of historic and recent trend to "likely reduced" and "likely declined", respectively.

There has been no change in the documented IK assessment of the SH subpopulation.

3. Current and Previous Harvest Limits

3.1 Current Harvest Limits

Current harvest limits are summarized in Table 2.

***Table 2**. Summary of current management of polar bear harvest (2018-2019 hunting seasons) by area within the Southern Hudson Bay subpopulation management unit (adapted from Lunn et al. 2018).*

	Area				
Management consideration	**Nunavut Settlement Area**	**Nunavik Marine Region†**	**Eeyou Marine Region‡**	**Québec (onshore region)**	**Ontario (onshore coastal region)**
Hunting season	July 1 – June 30	July 1 – June 30 [6]	No restriction	September 1 – May 31 [5]	
Who can hunt	Nunavut Inuit with a tag [1]	Nunavik Inuit and Eeyou Istchee Cree (within NMR/EMR overlap area)	Eeyou Istchee Cree	Nunavik Inuit and Cree	Treaty 9 rights holders in coastal communities (Cree)
Harvest limit (2018-2019)	TAH of 25 [2]	TAT of 23 (including 1 bear for Cree) [6]	No take limits since expiry of voluntary agreement in November 2016	No take limits since expiry of voluntary agreement in November 2016	None[7]
Protection for females and cubs	Yes [3]	Yes [6]	No	Yes [5]	Yes [8]
Protection for bears in dens	Yes [4]	Yes [6]	No	Yes [5]	Yes [8]

† Includes the "Inuit Zone" and the "Joint Inuit/Cree Zone" of the Inuit/Cree Offshore Overlapping Interests Area

‡ Includes only the "Cree Zone" of the Inuit/Cree Offshore Overlapping Interests Area

[1] *Nunavut Wildlife Act*, s.18(1); [2] *Nunavut Wildlife Act,* s.120; [3] *Nunavut Wildlife Act*, s.195, r. 9(2) - Regulatory provisions on harvesting; [4] *Nunavut Wildlife Act*, s.195, r. 9(3) - Regulatory provisions on harvesting;[5] Hunting season, protection of mothers and cubs and protection of bears in dens is not legally mandated, but is regulated in accordance with a voluntary agreement between the Gouvernement du Québec and the Inuit (Anguvigak - Nunavik Hunters, Fishers and Trappers' Association, 1984); [6] According to Nunavut and ECCC Ministers' decision in October 2016, but currently not enforced by legislation. [7]A voluntary quota of 30 bears was established in 1976 through an informal agreement between the Ontario Government and coastal Cree First Nation communities, whereby a maximum of 30 hides would be sealed in any year. In September 2009, polar bears were listed under Ontario's Endangered Species Act, which prohibits the sale of polar bear parts within Ontario. Thus, hides are no longer sealed in Ontario. [8]Protection provided under Endangered Species Act. There is no special protection provided to females and cubs or bears in dens in relation to Treaty 9 rights holders from coastal communities.

3.2 Previous harvest Limits and Reported Harvest

Table 3 summarizes harvest limits and reported harvest levels in Nunavut, Québec and Ontario since the 1994/1995 hunting season. Additional commentary, and information about harvest before the 1994/1995 hunting season is provided for the respective jurisdictions in sections that follow.

Table 3*. Polar bear harvest according to provincial/territorial jurisdiction for the Southern Hudson Bay (SH) polar bear subpopulation from the 1994/1995 to 2021/2022 hunting season. Limit denotes the Total Allowable Harvest (TAH), Total Allowable Take (TAT), or Voluntary Agreement (VA) limit. H denotes the total number of polar bears reported as having been harvested or killed in defense of life and property situations each year.*

Hunting season	Nunavut†		Québec‡		Ontario	
	Limit	H	Limit	H	Limit	H
1994/1995	TAH = 25	25	None	3	None[1]	2
1995/1996	TAH = 25	25	None	15	None[1]	11
1996/1997	TAH = 25	25	None	19	None[1]	3
1997/1998	TAH = 25	24	None	10	None[1]	11
1998/1999	TAH = 25	25	None	14	None[1]	3
1999/2000	TAH = 25	25	None	16	None[1]	5
2000/2001	TAH = 15	8	None	6	None[1]	7
2001/2002	TAH = 25	25	None	18	None[1]	9
2002/2003	TAH = 25	25	None	6	None[1]	8
2003/2004	TAH = 25	25	None	11	None[1]	8
2004/2005	TAH = 25	25	None	0	None[1]	2
2005/2006	TAH = 25	25	None	6	None[1]	4
2006/2007	TAH = 25	25	None	10	None[1]	3
2007/2008	TAH = 25	25	None	4	None[1]	5
2008/2009	TAH = 25	26	None	9	None[1]	3
2009/2010	TAH = 25	25	None	36	None[1]	1
2010/2011	TAH = 30	30	None	74	None[1]	0
2011/2012	TAH = 25	25	VA = 30	22	None[2]	4
2012/2013	TAH = 25	26	VA = 30	33	None[2]	2
2013/2014	TAH = 25	27	VA = 30	11	None[2]	0
2014/2015	VA = 20	20	VA = 23	22	None[3]	1
2015/2016	VA= 20	20	VA = 22	19	None[3]	2

2016/2017	TAH = 25	22	TAT=23	7	None	2
2017/2018	TAH = 25	28	TAT=23	5	None	0
2018/2019	TAH = 25	23	TAT = 23	11	None	5
2019/2020	TAH = 25	23	TAT = 23	7	None	5
2020/2021	TAH = 47	47	TAT = 23	7	None	1
2021/2022	TAH = 31	31	TAT = 23	6	None	0

† In 2014/2015 Inuit in Sanikiluaq voluntarily reduced their harvest quota to 20 polar bears (hence the change to VA = 20 in 2014/2015). In 2016/2017 Sanikiluaq reverted the TAH that was established by the NWMB before the voluntary reduction. In this table, the TAH reflects the annual harvest limit after all reductions or additions to the limit have been made; the annual limit fluctuates to account for harvest that exceeds the base allocation and credit usage.

‡ The TAT that has been in place since 2016/2017 applies only to the Nunavik Marine Region, including the "Inuit Zone" and the "Joint Inuit/Cree Zone" but excluding the "Cree Zone" of the Inuit/Cree Offshore Overlapping Interests Area. There is no TAT in force on the remaining portion of the Eeyou Marine Region nor on the mainland of Québec.

[1]A voluntary quota of 30 bears was established in 1976 through an informal agreement between the Ontario Government and coastal Cree First Nation communities, whereby a maximum of 30 hides would be sealed in any year. In September 2009, polar bears were listed under Ontario's Endangered Species Act, which prohibits the sale of polar bear parts within Ontario. Thus, hides are no longer sealed in Ontario.

[2]A voluntary limit of 5 bears was agreed upon by the coastal Cree communities of Ontario in attendance at the 2011 Inukjuak meeting, however not all communities were present.

[3]A voluntary limit of 3 bears to be split between Ontario and Québec Cree, with alternating division per season starting with 2 for Ontario Cree in 2014/2015 was agreed upon by the coastal Cree communities of Ontario in attendance at the 2014 Ottawa meeting, however not all communities were present.

3.2.1 Nunavut

Sanikiluaq is the only Nunavut community that harvests from the SH subpopulation. Sanikiluaq currently has a population size of 1,010 residents (Statistics Canada 2023). Harvest reporting is believed to approach 100%. Between 2000 and 2022 there have been 554 polar bears reported as harvested (Source: Nunavut polar bear database). The proportion of the harvest comprised of males during this time has averaged 0.69 (range: 0.57 – 0.84) (i.e., 2 males for every 1 female). In general, the community has adhered strictly to its TAH (see Figure 2).

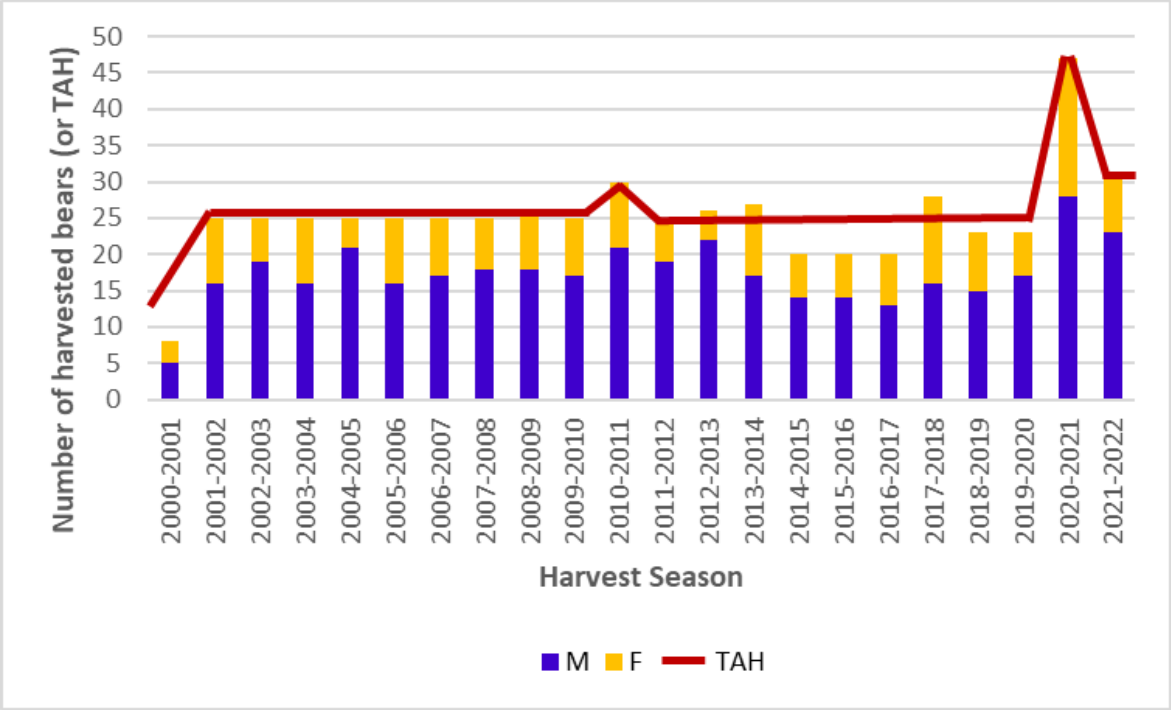

Figure 2. *Sanikiluaq polar bear harvest by sex between 2000/2001 and 2021/2022. During this time, harvest has been at or below the TAH in nearly all years. In 2010/2011, the HTO applied credits to increase their TAH as per their flexible quota system. In 2017/2018, removals exceeded TAH due to defense of life and property kills. In 2020/2021 and 2021/2022, the HTO applied credits to increase their TAH as part of their Harvest Administration and Credit Calculation System***.**

3.2.2 Québec-EMR-NMR

In Québec, there are three Nunavik Inuit communities (Inukjuak, Umiujaq, and Kuujjuaraapik with a collective population size of 3,154 residents; Statistics Canada 2023) and five coastal Cree communities (Whapmagoostui, Waskaganish, Chisasibi, Wemindji, and Eastmain with a collective population size of 10,916 residents; Statistics Canada 2023) that potentially harvest from this subpopulation. However, polar bear take by Cree in the SH subpopulation occurs primarily in defense of life and property situations.

Although there is no legal requirement for beneficiaries of the James Bay and Northern Québec Agreement to report human-caused polar bear mortalities in Québec, the Québec Government has been compiling harvest reports and issuing tags since 1985 to allow hunters to sell and export their polar bear hides, pursuant to provincial regulations, as well as internationally under the *Convention of International Trade in Endangered Species of Wild Fauna and Flora* (CITES), which Canada implements through the Wild Animal and Plant Protection and Regulation of International and Interprovincial Trade Act (WAPPRIITA).

The proportion of the actual harvest being reported is currently unknown in Québec. It is, however, likely that there is a link between the probability of reporting polar bear harvest and the harvester's interest to sell the hide, which is in turn influenced by the market price of polar bear hides. The existence of voluntary agreements, establishing maximum annual take for the various harvesters of the SH subpopulation between the 2011/12 and 2015/16 harvest seasons, as well as the implementation of a Total Allowable Take (TAT) since the 2016/2017 hunting season may also have influenced the reporting rates. Figure 3 presents the proportion of males and females in the reported harvest. Table 4 presents reported harvest levels in Québec categorized according to community.

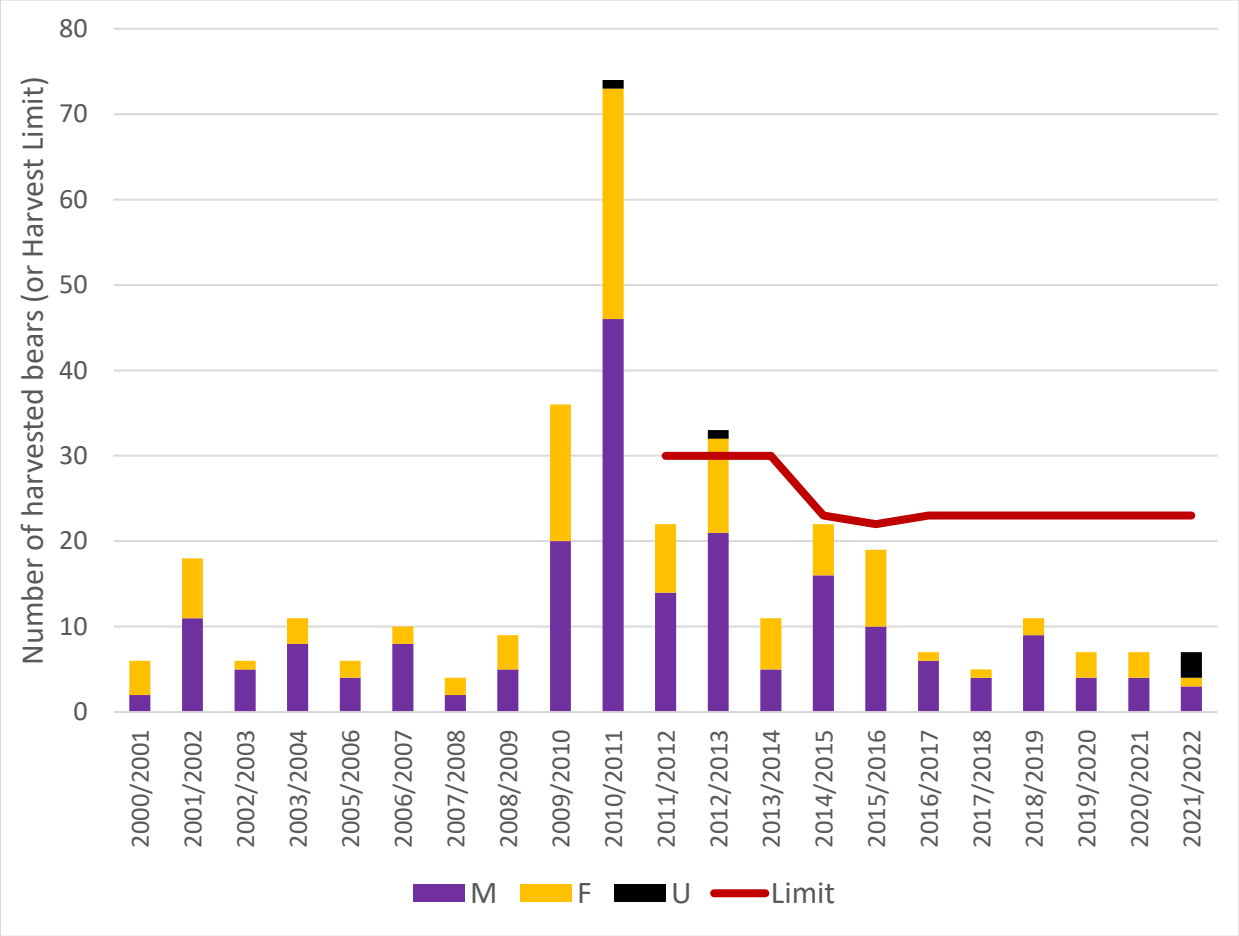

Figure 3. *Québec overall polar bear harvest by sex between 2000/2001 and 2021/2022. A voluntary agreement was in place between the 2011/2012 and 2015/2016 harvest seasons. A TAT has been in place since the 2016/2017 harvest and applies only to the Nunavik Marine Region, including the "Inuit Zone" and the "Joint Inuit/Cree Zone" but excluding the "Cree Zone" of the Inuit/Cree Offshore Overlapping Interests Area. There is no TAT in force on the remaining portion of the Eeyou Marine Region nor on the mainland of Québec.*

Table 4. *Reported polar bear harvest within the SH polar bear subpopulation, according to Québec community, since the 1985/1986 to 2021/2022 hunting season. TAT denotes a Total Allowable Take determined by the relevant Wildlife Management Boards (NMRWB and EMRWB). VA denotes a harvest limit determined by a voluntary agreement.*

Hunting season	Harvest limit	Inukjuak†	Umiujaq†	Kuujjuarapik†	Whapmagoostui‡	Waskaganish‡	Chisasibi‡	Wemindji‡
1985/1986	None	11	0	2	0	0	0	0
1986/1987	None	12	0	0	0	0	0	0
1987/1988	None	9	0	2	0	0	0	0
1988/1989	None	45	0	0	0	0	0	0
1989/1990	None	36	0	4	0	0	0	0
1990/1991	None	15	1	0	0	0	0	0
1991/1992	None	12	0	5	0	0	0	0
1992/1993	None	17	0	0	0	0	0	0
1993/1994	None	11	0	1	0	0	0	0
1994/1995	None	2	0	1	0	0	0	0
1995/1996	None	11	1	3	0	0	0	0
1996/1997	None	16	0	2	0	1	0	0
1997/1998	None	9	0	1	0	0	0	0
1998/1999	None	14	0	0	0	0	0	0
1999/2000	None	14	1	1	0	0	0	0
2000/2001	None	5	1	0	0	0	0	0
2001/2002	None	16	1	0	0	0	1	0
2002/2003	None	6	0	0	0	0	0	0
2003/2004	None	10	0	0	0	0	1	0
2004/2005	None	0	0	0	0	0	0	0

2005/2006	None	6	0	0	0	0	0	0
2006/2007	None	9	0	0	0	1	0	0
2007/2008	None	2	0	2	0	0	0	0
2008/2009	None	9	0	0	0	0	0	0
2009/2010	None	36	0	0	0	0	0	0
2010/2011	None	71	0	2	1	0	0	0
2011/2012	VA = 30	19	0	2	0	0	1	0
2012/2013	VA = 30	30	0	0	0	3	0	0
2013/2014	VA = 30	9	0	0	0	2	0	0
2014/2015	VA = 23	20	1	0	0	1	0	0
2015/2016	VA = 22	19	0	0	0	0	0	0
2016/2017	TAT=23[1]	4	1	1	0	1	0	0
2017/2018	TAT=23[1]	4	0	1	0	0	0	0
2018/2019	TAT=23[1]	10	0	1	0	0	0	0
2019/2020	TAT=23[1]	5	0	2	0	0	0	0
2020/2021	TAT=23[1]	4	0	0	0	2	1	0
2021/2022	TAT=23[1]	4	0	0	0	0	1	1

† Inuit communities; ‡ Cree communities

[1] The TAT that has been in place since 2016/2017 applies only to the Nunavik Marine Region, including the “Inuit Zone” and the “Joint Inuit/Cree Zone” but excluding the “Cree Zone” of the Inuit/Cree Offshore Overlapping Interests Area. There is no TAT in force on the remaining portion of the Eeyou Marine Region nor on the mainland of Québec.

3.2.3 Ontario

The Government of Ontario's *Recovery Strategy for Polar Bear in Ontario* (Tonge and Pulfer 2011) indicates that, at the time of publication, harvest by members of Treaty 9 in Ontario was considered sustainable, based upon the best available data for population abundance (Lunn et al. 2006). In 1976, a voluntary limit of 30 bears was established through an informal agreement with the coastal Cree communities, whereby up to 30 hides could be sealed for sale annually [12 to Fort Severn, 12 to Winisk (Peawanuck), 6 shared between Attawapiskat, Fort Albany and Kashechewan] (Ontario Ministry of Natural Resources 1980, 2008). During the 1970s and 1980s annual Ontario harvest averaged 20.7 individuals (Kolenosky et al. 1992). In September 2009, polar bears were listed as threatened under Ontario's Endangered Species Act, which prohibits the sale of polar bear parts within Ontario. Thus, hides are no longer sealed in Ontario, and this agreement is largely obsolete.

Ontario's harvest has been considerably lower than the 30 bear limit, averaging 4.2 polar bears annually from 1994/1995 to 2016/2017, and 2 polar bears annually from 2011/2012 to 2021/2022 (Source: Ontario Ministry of Natural Resources and Forestry database). However, polar bear take by Cree in Ontario occurs primarily in defense of life and property situations. Ontario Coastal Cree communities were present at the meetings to establish voluntary quotas in 2011 and 2014, however not all communities were represented, and thus unable to formally agree to the quotas. Currently, Ontario has no formal means of tracking polar bear harvest or defense of life and property kills.

3.3 Voluntary Agreements and Harvest Limits

<u>2011 Voluntary Agreement</u>

In September 2011, a user-to-user meeting was held in Inukjuak, Québec. The meeting was convened in response to a high removal of polar bears by Inuit hunters during the 2010/2011 hunting season (reported harvest = 104, 73 by Nunavik Inuit, 30 by Nunavut Inuit, 1 by Eeyou Istchee Cree) and associated concern raised by domestic and international parties about the sustainability of harvest. The meeting was attended by officials representing the responsible governments, WMBs, land claims organizations, and hunters from Nunavut, Ontario and Québec. However, not all of the coastal Cree communities in Ontario were represented.

The parties recognized the need to limit the level of take from the SH subpopulation and for WMBs to collaborate in their decision-making. A voluntary agreement was drafted for the 2011/12 harvest season. Key features of 2011 voluntary agreement included:

- A temporary limit to take (including subsistence hunting and defense kills / on-land and off-shore):
    - QC: 26 for Nunavik Inuit, and 4 for Eeyou Istchee Cree;
    - NU: 25 for Nunavut (i.e. Nunavut's existing quota);
    - ON: 5 for the six coastal Cree Nations of Ontario.

- The need to build a formal management system for Nunavik and conduct a new population survey.

- Commitment to review harvest levels when new population data becomes available.

- An international export limit of 60 polar bear hides.

The voluntary agreement was renewed for the 2012/13 hunting season. In 2013/14, a formal renewal was not undertaken, but low harvest levels were reported.

The full agreement is included as Appendix A to this document.

2014 Voluntary Agreement

In September 2014, hunters, Inuit and Cree organizations and governments involved in the management of the SH polar bear subpopulation met in Ottawa and came to a voluntary agreement with regard to the harvest of polar bears in accordance with the respective hunting seasons of each jurisdiction. The agreement was in effect from November 2014 until November 2016. Meeting participants recognized the important commitment of hunters to the conservation and sustainable use of polar bears. Significant compromises were made by respective Indigenous stakeholders. Participants agreed to the following voluntary limits to the annual take (including subsistence hunting and defense kills) to be implemented for the 2014/15 and 2015/16 hunting seasons:

- 22 for Nunavik Inuit;
- 20 for Nunavut Inuit;
- 3 in total for Ontario and Québec Cree, with alternating division per harvest season starting with 1 for Québec Cree and 2 for the Ontario Cree. Not all of the coastal Cree communities in Ontario were represented and thus unable to agree to the limits.

It was also agreed that the limits should be implemented in the context of sex-selective harvest and a flexible quota system, where applicable.

The full agreement is included as Appendix B to this document.

3.4 Cree Nation Government Perspective Concerning Polar Bear Harvest

The Cree of Eeyou Istchee periodically take bears that have entered or approached hunting camps located on islands or on promontories along the eastern James Bay coast of their territory in Québec. The number varies from one year to the next, and several years may pass with no kills. However, it is quite possible that four, five or six bears might be taken in a given year, especially in the Charlton Island archipelago. These islands are south of the southern limit of the Nunavik Marine Region. There is no established TAT in this area.

The situation is somewhat similar to that on the west coast of James Bay, including Akimiski Island (Nunavut).

In the view of the Cree Nation Government, a comprehensive approach to SH subpopulation management should involve communities on both coasts in decisions involving the reporting of defense of life and property, or the introduction of specific measures to reduce defense of life and property kill mortality. The EMRWB is currently compiling information on polar bear sightings and encounters and this information will be made available to interested parties.

4. Indigenous Knowledge

4.1 Inuit knowledge in the Nunavik Marine Region

Background

In 2018, the NMRWB completed a report on findings from a comprehensive polar bear Inuit knowledge study in the three Nunavik communities (Kuujjuaraapik, Umiujaq, and Inukjuak) within the SH subpopulation range (NMRWB 2018). This study was conceived by the NMRWB upon receiving a request in 2012 from Canada's then Minister of Environment, the Honourable Peter Kent, that NMRWB work towards the development of a formal management regime for the harvest of polar bears in the Nunavik Marine Region and specifically to establish a Total Allowable Take. As the NMRWB considers the knowledge, traditions, and hunting practices of Nunavik Inuit in its decisions and actions, this project was deemed necessary to document information necessary for NMRWB decisions on polar bears. The project was designed to not only focus on gathering information directly applicable to management decisions, but to document as comprehensive a report as possible on the Inuit Knowledge of polar bears in the three communities.

Key Findings

The findings presented here are the outcome of 13 separate semi-directed interviews conducted with 25 elders, hunters, and knowledge holders. Data was analyzed from over 24 hours of interview audio recordings and transcripts, and 240 features mapped through a participatory mapping component of the study. An average of ten participants were sought per community, with the ability to increase or decrease the number according to the point at which redundancy of information was found. Findings should be considered within the scope of the project and should not be considered to indicate the full extent of Inuit Knowledge on polar bears from the area.

Ecology and biology

- There has been a clear increase in polar bear numbers in the SH subpopulation since the 1970s. In Umiujaq it is only within the last 25 years that bears have been seen with any consistency.
- SH subpopulation polar bears have increased their distribution. The use of inland areas was noted, including bears being found and hunted several kilometers inland of Inukjuak.

- The condition of SH subpopulation polar bears was reported to be very healthy, fatter in the winter and skinnier in the summer, but rarely so skinny that participants were concerned about the bear's health.
- A number of frequently used denning areas were identified. They were typically located in areas commonly accumulating significant snow depth and usually close to the coast, although in some instances at considerable distance inland.
- The preferred diet of SH subpopulation polar bears is ringed seals, but many alternative prey items were reported, frequently including bird eggs and belugas.

Management and stewardship

- It is believed that traditional stewardship practices are sufficient for conservation and that the introduction of a quota to limit polar bear hunting is unnecessary.
- Further, participants noted that introduction of quotas could possibly be dangerous or counterproductive. There is concern that a quota may create competition and encourage hunters to take animals they would otherwise not hunt or take them at less optimal seasons.
- Some common stewardship practices currently used include hunting only based on need and not wasting any of the animal killed, not hunting polar bears during the summer and not harvesting cubs or known mothers.
- If a quota system is to be discussed, participants want to ensure that their knowledge is considered in this plan, that any plan consider the conservation strategies identified above and, most of all, that any plan be fair to all communities and hunters in the region.
- Polar bear hunting remains an integral part of Nunavimmiut culture, society, identity and economy today.

It was clear that participants are concerned with both the health of polar bear populations, as well as the aspects of Inuit livelihood which are closely associated and integrated with polar bears. A close and complex relationship between Inuit and polar bears is clearly evident in this study, and consideration of this will be important in creating and implementing effective management measures which represent the people affected by them (Berkes 2009).

4.2 Nunavut Inuit Qaujimajatuqangit

Voices from the Bay: Traditional Ecological Knowledge of Inuit and Cree in the Hudson Bay Bioregion (McDonald et al. 1997) provides insights into the environment of Southern Hudson Bay. More recent local observations have been captured through submissions made by the Sanikiluaq Hunter's and Trapper's Organization (HTO) to Environment and Climate Change Canada during consultations on polar bears as a species at risk and to the Nunavut Wildlife Management Board with respect to the Nunavut Polar Bear Management Plan (Sanikiluaq HTO 2018). Participants from Sanikiluaq "emphasized that they know the polar bear population is increasing rather than decreasing, in other communities as well as in Sanikiluaq. In the past, hardly any polar bears were seen around Sanikiluaq. Now, people cannot go camping due to fear of bears. Cabins and caches have been destroyed by bears. Participants said that they do

not believe climate change will cause the disappearance of polar bears as they can hunt in water. They said that Inuit Knowledge should be considered more. According to IQ, it is normal for the polar bear population to increase and decrease, in a cycle" (CWS 2009:24).

4.3 Traditional Ecological Knowledge of Polar Bears in the Eeyou Marine Region

A Traditional Ecological Knowledge study based on interviews with land users was held jointly by the Cree Nation Government, the Eeyou Marine Region Wildlife Board and the Cree Trappers' Association. The interviews were conducted in 2017 and the report was completed in 2020 (EMRWB 2020). The objective of the study was to provide a comprehensive portrait of the role and importance of polar bear to the Cree in the region.

The study provides a significant amount of traditional knowledge, as well as current observations and concerns. One of the main contributions was to locate the geographic areas where most observations and/or human bear conflict incidents have occurred in the last 25 years. Maps depict the locations that have been frequented by polar bears in recent years, as well as harvest sites and denning locations.

Although a fair amount of information and knowledge was shared in the course of the study, it is important to note that the information in the report is limited to that shared by participants. It does not represent all possible Cree knowledge of polar bears from the region.

One element that came out of the consultation was the importance, respect, and concern that many participants expressed on the subject of polar bears. Many had observations and stories to share. However, participants also expressed concerns about an increase in relative abundance of polar bears in the Eeyou Marine Region and the growing number of interactions between Cree and polar bears, many of which have been undesirable or threatening. Climate change and, more specifically, changes in sea ice dynamics in Hudson Bay and James Bays were mentioned as potential causes for the increase. Some land users suggested that polar bears are extending their distribution area southward because of difficulty hunting seals and that dietary changes may be occurring as a way for polar bears to adapt to a changing environment.

Deliberate hunting of polar bears is not a traditional activity for the Cree. However, defense of life and property kills were reported by several land users. In addition, the fact that many land users felt a growing threat from polar bear during their traditional activities on the land emphasizes the importance of developing and raising awareness on safety guidelines and preventive measures. For their protection, land users have to be prepared to use deterrent and lethal methods if required. However, many preventive measures can be used to avoid attracting the bears in the first place.

Just like polar bear are in the process of adapting to a changing environment, it appears that the land users of Eeyou Istchee also need to adapt to more frequent encounters with polar bears and potential dangers associated with the presence of polar bears on the land.

Laforest et al. (2018) conducted semi-directed interviews on the subject of polar bear biology and climate change with Cree elders in the northern Eeyou Marine Region. The interviews were conducted in 2012 in Wemindji, Chisasibi, and Whapmagoostui. The interviews held in Whapmagoostui also included elders from Kuujjuarapik, the adjacent Inuit community. Laforest et al. reported that participants were unanimous in their recognition of a warming climate and prolonged ice-free season in the area. However, communities and respondents differed in their observations on other issues, with latitudinal trends evident in observations of polar bear distribution, denning activity, and foraging habits. Communities also differed in their perception of the prevalence of 'problem' polar bears and the conservation status of the species. One-third of participants held the view that polar bears will be unaffected by, or even benefit from, longer ice-free periods. A majority of participants indicated that the local polar bear population was stable or increasing in abundance.

Laforest's observations should be reviewed with representatives of the three communities which he visited, as well as with Waskaganish and Eastmain further to the south. The majority of bear encounters (and bear mortality) in recent years have occurred in the territories used by these two southern communities. The experience, in the case of Charlton Island in particular, has drawn attention to the importance both of lines of communication as well as of clear responsibilities for reporting events subsequent to encounters (including the responsibility for cubs taken, or abandoned, in this process). There are observations of bears travelling inland at the latitude of Chisasibi, and it would be helpful to know whether denning is taking place on the Québec side of James Bay. It is also worth noting that a recent succession of late springs, and the accumulation of rafted ice along the coast, may also have implications for bear behaviour (and vulnerability to hunting). It may be worth further enquiries, given the probable significance of ice cover in James Bay for bear distribution and behaviour in the future.

5. Scientific Assessment

5.1 Subpopulation Abundance

5.1.1 Early Assessments of Abundance

The first abundance estimate for the SH subpopulation came from a three-year (1984–1986) mark-recapture study, conducted mainly along the Ontario coastline of Hudson Bay, from Hook Point to the border with Manitoba (Kolenosky et al. 1992). The initial estimate obtained from that study (763 ± 323 bears) was later corrected to 641 bears (95% CI: 401 – 881) after a re-analysis of the original capture data (Obbard et al. 2007) but covered only the Ontario coastline. A subsequent 3-year capture-recapture study (2003–2005), covering again the Ontario coastline from Hook Point to the border with Manitoba, produced an estimate of 681 bears (95% CI: 401–961) (Obbard et al. 2007). An analysis of bears captured on Akimiski Island in James Bay during 1997 and 1998 resulted in the addition of 70–110 bears (Obbard et al. 2007) and the total SH subpopulation was therefore estimated by the PBTC to be between 900-1000 bears for management purposes. Results from the two capture-recapture studies suggested that the

abundance was stable between 1984–1986 and 2003–2005, though survival rates in all age and sex categories and body condition declined (Obbard 2008).

5.1.2 Aerial Surveys Conducted in 2011/12 and 2016

An aerial survey was conducted during the fall ice-free season over mainland Ontario and Akimiski Island in 2011 and over the remaining islands in James Bay, the coastal areas of Québec from Long Island to the SH–FB subpopulation border, and the off-shore islands in eastern Hudson Bay in 2012. This survey covered all areas sampled for the capture-recapture studies as well as a substantial area not covered by those surveys. Results of this mark-recapture distance- sampling (MRDS) analysis provided an estimate of 860 bears (95% CI: 580–1,274) in the mainland Ontario, neighboring islands, and Akimiski Island portions of the SH subpopulation management unit during the 2011 ice-free season plus an additional 83 bears (SE = 4.5) in the 2012 study area. Thus, combining the aerial survey results from 2011 and 2012 yielded an overall estimate of 943 bears (SE: 174, 95% CI: 658–1350) for the SH subpopulation (Obbard et al. 2015). Overall, despite the difference in methodologies, assumptions, and biases between capture–recapture studies and aerial surveys, these lines of evidence suggest it is likely that the subpopulation had a stable abundance between the mid-1980s and 2012, or that any changes were undetectable due to differences in methodology. Nevertheless, the duration of sea ice within the bounds of the SH subpopulation declined over this period (Hochheim and Barber 2014, Stern and Laidre 2016, NMRWB 2018) and scientific research also indicates a decline in body condition and body size of bears during that same period (Obbard et al. 2016, M.E. Obbard unpublished data).

An intensive aerial survey, covering the same areas as the 2011/12 survey, was repeated in September 2016 to re-assess SH abundance. All areas in Ontario, Nunavut and Québec were sampled within a 3-week period to ensure complete coverage within the same season and year. The abundance estimate obtained from that survey was 780 bears (95% CI: 590–1029). Although the 95% confidence interval of both surveys overlapped, the 17% decline between the point estimates suggested that the subpopulation may have declined between 2012 and 2016. The proportion of yearlings in the observed portion of the subpopulation also declined from 12% in 2011 to 5% in 2016, whereas the proportion of cubs remained similar (16% in 2012 vs. 19% in 2016) suggesting a low survival of cubs to the yearling age class (Obbard et al. 2018).

5.1.3 Supplemental Aerial Surveys Conducted in 2018

To assess if the apparently low survival rate of cubs born in 2015 was an unusual event or represented an ongoing trend for the SH subpopulation and to obtain an additional abundance estimate for a portion of the subpopulation, a partial survey of the Ontario coastline was conducted in September 2018. This survey consisted of flying a single transect parallel to the coast for the entire coastline of Ontario and Akimiski Island. The survey used double-observer mark-resight methods and was an exact repeat of a portion of the 2011 and 2016 surveys. The 2018 survey was designed to cover the area with the highest density of bears. The results of this survey indicated a slightly lower abundance in the coastal area in 2018 (249 bears, 95% CI: 230 – 270) than in 2016 (269 bears, 95% CI: 244 – 297) and significantly lower abundance than

in 2011 (422 bears, 95% CI: 381 – 467; significance based on overlap of 95% CI). The proportion of yearlings in the coastal area for the three surveys was variable (2011: 12%, 2016: 3%, 2018: 7%) as was the number of cubs (2011: 15%, 2016: 17%, 2018: 10%), but the proportion of adults in the coastal area increased in each survey (2011: 60%, 2016: 71%, 2018: 74%). The results of the 2018 survey should be used tentatively, as they are not a complete sample of the subpopulation. However, the number of observed bears represents >25% of the estimated subpopulation, suggesting these numbers are at least a useful piece of additional information. Although these results suggest that cub survival to the yearling age class is not consistently low, the proportion of dependent animals seen in the coastal area has declined in every year, tentatively suggesting that reproductive output has been reduced. Further, the nearly identical estimates of abundance in 2018 and 2016 for the coastal area and the significant differences for the same area in 2011 corroborate the finding from Obbard et al. (2018) that the population had likely declined.

5.1.4 Aerial Survey Conducted in 2021

A third comprehensive aerial survey was conducted in August and September 2021 to provide a third estimate of the abundance of the SH subpopulation. This survey followed a nearly identical design as the two previous surveys with all of the same areas sampled and survey methods used. The one minor difference from 2016 was that areas inland from the Québec coast were not flown due to no bears being seen in those areas in 2016 and after discussion with Nunavik communities that agreed that few bears are in that area during the ice-fee season. The coastline and nearshore islands of Québec were still flown. Although the field methods were nearly identical to the 2011/12 and 2016 surveys, recent advancements in distance sampling statistical modeling were applied to obtain a more robust estimate of the subpopulation abundance. However, this estimate was not directly comparable to the 2016 estimate. Thus, two sets of analyses were conducted: one designed to be maximally comparable to 2016 and one that made use of the recent statistical advances. The former approach produced an estimate of 1003 (95% CI 773-1301) and the latter produced an estimate of 1119 (860-1454). The most comparable estimate to the 2016 survey indicated a 29% increase in the number of bears in the subpopulation at the time of the survey. In addition, reproduction appeared to be robust with 18% of the observed bears being cubs and 18% being yearlings.

There are two possible reasons for the apparent increase from 2016-2021. The first is interannual variation in the on-land distribution of bears between WH and SH and the second is increased survival and reproduction of bears in SH. There is evidence in favor of both of these factors, so it is most likely that some combination of temporary movement and improved vital rates led to the increase. First, ongoing genetic capture-recapture work in SH and WH indicated that 20% of the sampled bears in 2021 in SH had previously only been sampled in WH, indicating movement into SH in that year. Further, the increase of 29% is on the extreme end of plausible given the slow life history strategy of polar bears. Thus, there is strong evidence that some of the bears in SH in 2021 summered in other years in WH. On the other hand, the years between 2016 and 2021 saw some of the best ice conditions over the last 10 years, along with substantially lower harvest of bears in SH compared to the period between 2010 and 2015

(37.8 bears compared to 58.8). In addition, reproduction appeared strong in SH and substantially stronger than in WH during the same time (ECCC unpublished data, Atkinson et al. 2022). Thus, there is also strong evidence of improved vital rates in SH. Taken together, these lines of evidence suggest that the increase in SH in 2021 relative to 2016 was driven by a combination of improved vital rates and movement, though to what degree is unclear.

5.2 Supplementary Information - Reproduction, Body Condition, Survivorship, and Movement

5.2.1 Reproduction

The first findings on reproduction for the SH subpopulation comes from Kolenosky and Prevett (1983), who assessed litter size and cub production by flying aerial surveys of the Ontario coast and Akimiski Island in February and March from 1974-1978. They estimated average litter size at 2.0. Annual cub production varied from 33-112 in the area sampled. Although data on litter size and litter production were collected during capture-recapture studies in the 1980s, this information is not reported in any published documents. The next available information on reproduction is reported in Obbard et al. (2010) from capture-recapture work in the early 2000s. They report litter size of cubs at 1.575 with a standard error of 0.116. They also report the litter production rate of different age classes of bears [4 year olds = 0.087 (SE 0.202); 5 year olds = 0.966 (SE = 0.821); and ≥6 year olds = 0.967 (SE=0.022)]. Obbard et al. (2016) reported cub litter size as 1.56 and the proportion of cubs in the observed bears as 0.16 from the 2011/12 aerial surveys. Obbard et al. (2018), reported a litter size of 1.46 (SD=0.5) and the proportion of cubs in the observed bears at 0.19 from the 2016 aerial survey. Unpublished aerial survey results from the coastal area, conducted in 2018 found a litter size of 1.47 (SD=0.61) and the proportion of cubs in the observed bears at 0.1 for the coastal area.

5.2.2 Body Condition

Obbard et al. (2016) examined trends in body condition for 900 bears captured during three different capture-recapture studies (i.e., 1984-1986, 2000-2005 and 2007-2009). These captures were made onshore during the ice-free period. A body condition index (BCI) was calculated for all bears according to the methods of Cattet et al. (2002), relating measurements of a bear's mass to its body length. BCI declined significantly over time in all age, sex, and reproductive classes. In addition to these body condition measures, analyses by Obbard, Newton and Howe (Ontario Ministry of Natural Resources and Forestry, unpublished data) indicate that female polar bears and cubs have seen marked declines in total body length, weight, and zygomatic arch width. Further, declines have been proportionally greatest in cubs, followed by adult females then adult males.

In Nunavut, body condition scores (BCS) of harvested polar bears have been determined for SH subpopulation since 2010. Most were harvested during winter and spring, while on the sea ice. BCS scoring follows a 5-scale rating system that has been used in other research studies (Stirling et al. 2008). The BCS of 191 polar bears (53 females and 138 males) was examined (2010-2017 data). 92.7% of the harvested bears had a BCS of average and better; only 4 bears were

deemed very skinny, and 10 were skinny. Throughout the reporting period for these BCS, average and above average bears were common every reporting year (Figure 3).

It is important to note that information about polar bear body condition collected in Ontario (ice-free period) and Nunavut (on ice, during winter and spring) were collected at different times of the year, and as such are not necessarily contradictory. Polar bears that are harvested out on the sea ice in winter and spring have had the opportunity to hunt and regain body mass lost the previous summer/fall while onshore.

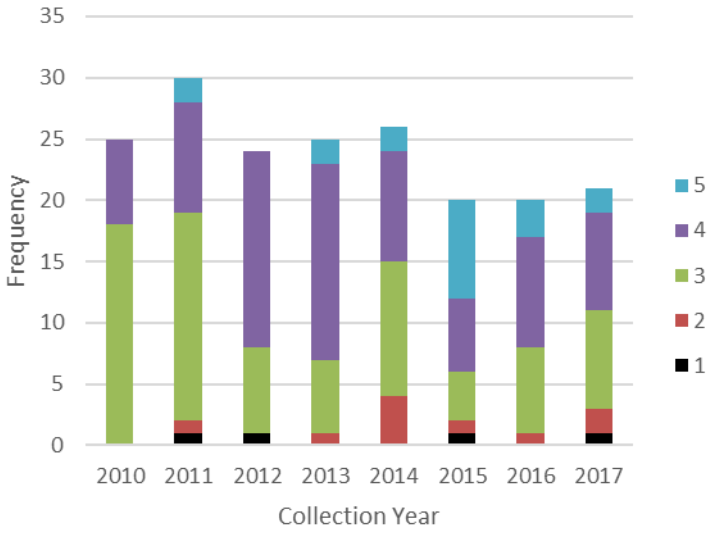

***Figure 3**: Frequency of body condition scores from 1 (skinny) to 5 (fat) for harvested bears of the Southern Hudson Bay Polar Bear Subpopulation between 2010 and 2017.*

5.2.3 Survivorship

Obbard et al. (2007) present the most up-to-date and robust estimates of survival in the SH subpopulation. The authors analyzed all capture-recapture data from 1984 through 2005 in one model to assess change in survival. They estimated substantial declines in survival of all age and sex classes from the 1980s through 2000s. Their results are reproduced in Table 5.

***Table 5**. Age-specific survival estimates of Southern Hudson Bay Polar Bear.*

Year	Female									
	COY		Yearling		Subadult		Adult		Senescent	
	Mean	95% CI	Mean	95% CI	Mean	95% CI	Mean	95% CI	Mean	95% CI
1984	0.768	0.550 - 0.986	0.767	0.549 - 0.985	0.936	0.685 - 1.00	0.936	0.685 - 1.00	n/a*	n/a*
1985	0.768	0.550 - 0.986	0.767	0.549 - 0.985	0.936	0.685 - 1.00	0.936	0.685 - 1.00	0.591	0.254 - 0.928
1986	0.702	0.686 - 0.718	0.701	0.685 - 0.717	0.909	0.780 - 1.00	0.909	0.778 - 1.00	0.534	n/a*
1999	0.749	0.589 - 0.908	0.746	0.587 - 0.905	0.930	0.869 - 0.991	0.930	0.868 - 0.991	0.561	0.334 - 0.788
2000	0.748	0.589 - 0.908	0.746	0.587 - 0.905	0.930	0.869 - 0.991	0.930	0.869 - 0.991	0.561	0.334 - 0.788
2001	0.748	0.588 - 0.908	0.746	0.587 - 0.905	0.930	0.869 - 0.991	0.930	0.868 - 0.991	0.561	0.334 - 0.788
2002	0.749	0.589 - 0.908	0.746	0.587 - 0.905	0.930	0.869 - 0.991	0.930	0.869 - 0.991	0.561	0.334 - 0.788
2003	0.644	0.380 - 0.909	0.64	0.373 - 0.907	0.893	0.792 - 0.993	0.892	0.791 - 0.993	0.444	0.153 - 0.735
2004	0.645	0.380 - 0.909	0.64	0.373 - 0.907	0.893	0.792 - 0.993	0.892	0.791 - 0.993	0.444	0.153 - 0.735
	Male									
	COY		Yearling		Subadult		Adult		Senescent	
	Mean	95% CI	Mean	95% CI	Mean	95% CI	Mean	95% CI	Mean	95% CI
1984	0.634	0.350 - 0.919	0.631	0.349 - 0.914	0.884	0.767 - 1.00	0.884	0.767 - 1.00	0.428	0.055 - 0.802
1985	0.635	0.350 - 0.919	0.631	0.349 - 0.914	0.884	0.767 - 1.00	0.884	0.767 - 1.00	0.428	0.055 - 0.802
1986	0.591		0.593		0.838	0.778 - 0.898	0.838	0.778 - 0.897	0.486	
1999	0.607	0.410 - 0.805	0.602	0.408 - 0.795	0.873	0.776 - 0.971	0.873	0.776 - 0.971	0.394	0.144 - 0.644
2000	0.607	0.410 - 0.804	0.602	0.408 - 0.795	0.873	0.776 - 0.971	0.873	0.776 - 0.971	0.394	0.144 - 0.644
2001	0.607	0.409 - 0.806	0.602	0.408 - 0.795	0.873	0.776 - 0.971	0.873	0.775 - 0.971	0.394	0.144 - 0.644
2002	0.607	0.410 - 0.805	0.602	0.408 - 0.796	0.874	0.776 - 0.971	0.874	0.776 - 0.971	0.394	0.144 - 0.645
2003	0.491	0.211 - 0.771	0.485	0.204 - 0.765	0.812	0.663 - 0.961	0.811	0.662 - 0.960	0.293	0.029 - 0.558
2004	0.492	0.211 - 0.772	0.485	0.204 - 0.766	0.812	0.663 - 0.961	0.811	0.662 - 0.961	0.293	0.029 - 0.588

5.2.4 Movement

Although there has been relatively limited information published on the movements of marked bears in the SH subpopulation, substantial data are available. Obbard and Middel (2012) examined the boundaries of the SH subpopulation using movements of radio collared bears. They found that movements largely conformed to the current management boundaries, but that there were regular movements into other subpopulations while on the sea ice. Preliminary analysis of marked and subsequently harvested bears suggests bears that were originally marked in WH are regularly harvested in SH and vice versa, with a greater proportion of WH bears harvested in SH. Despite substantial overlap among bears from the SH, WH and FB subpopulations while on the sea ice, movement data indicate a high degree of fidelity to onshore areas used during summer. Small mating season home ranges, coupled with geographic isolation, is believed to have contributed to a high degree of genetic distinctiveness for polar bears in James Bay relative to other locations (Obbard and Middel 2012, Crompton et al. 2008, Viengkone et al. 2016, 2018).

5.3 Sea Ice Conditions

Stern and Laidre (2016) evaluated changes in the timing of spring sea ice retreat and fall sea ice advance for all 19 global polar bear subpopulations, from 1979-2014, using a common set of sea ice metrics across subpopulations. Their methodology has been adopted by the Polar Bear Specialist Group (PBSG) as an indicator of the availability of sea-ice habitat in the PBSG's status table (http://pbsg.npolar.no/en/status/status-table.html). Full methodological details are provided in Stern and Laidre (2016).

The analysis indicated earlier sea ice retreat and later sea ice advance in all 19 subpopulations. Trends generally ranged from a 3 to 9 day earlier spring sea ice retreat and a 3 to 9 day later fall sea ice advance per decade across subpopulations. SH, which is the most southerly of all subpopulations, had among the shortest duration sea-ice coverage periods (approximately 210 days above the 15% ice coverage threshold used by the authors; Figure 5, panel S5). While sea ice loss has been extensive in the SH subpopulation over the last four decades, the rate of sea ice loss has been less extreme than what has been observed in other polar bear subpopulations (Table 5).

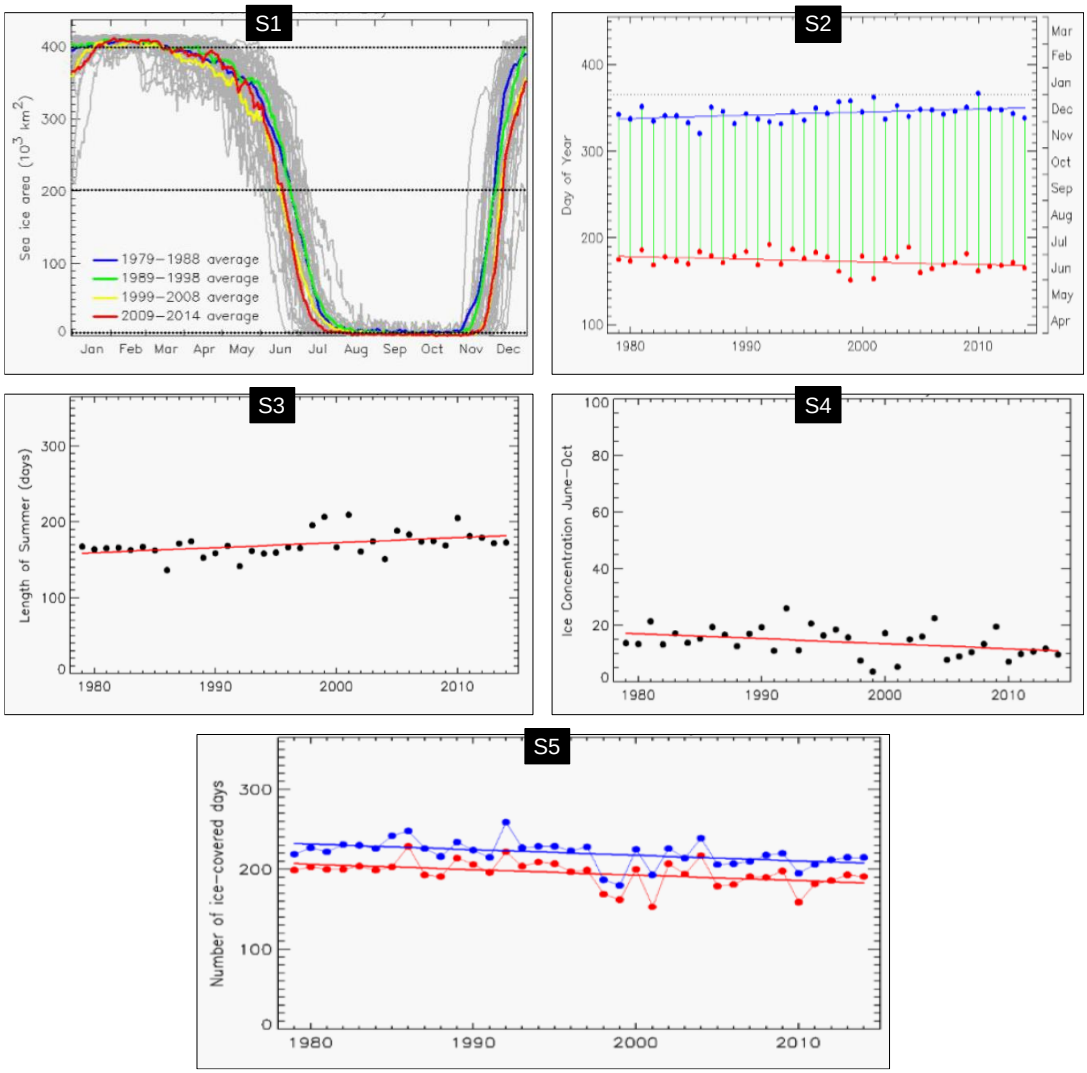

Figure 5. *Reproduction of figures included in supplementary materials of Stern and Laidre (2016) for the Southern Hudson Bay Polar Bear Subpopulation.* ***Panel S1****: Daily sea-ice area, January-December 5, 1979-2014 (gray curves). Colored curves are decadal averages. Upper horizontal dotted line is average sea-ice area in March; lower horizontal dotted line is average sea-ice area in September; middle horizontal dotted line is threshold for determining dates of spring sea-ice retreat and fall sea-ice advance.* ***Panel S2****: Dates of sea-ice retreat (red) and sea-ice advance (blue) for 1979-2014. The red and blue lines are least-squares fits. The vertical green lines indicate the time interval between retreat and advance (i.e., length of summer season).* ***Panel S3****: Length of the summer season (from spring sea-ice retreat to fall sea-ice advance) versus year, with least-squares line in red.* ***Panel S4****: Summer (June through October) sea-ice concentration versus year, with least-squares line in red.* ***Panel S5****: Number of ice-covered days per year, 1979-2014. An ice-covered day is one in which the sea-ice area exceeds a threshold (defined in main text of Stern and Laidre 2016). Blue: number of ice-covered days above 15% threshold. Red: number of ice-covered days above 50% threshold. Least-squares lines are also shown.*

***Table 5**. Reproduction of PBSG status table columns summarizing trends in sea ice coverage according to global polar bear subpopulation (PBSG 2018).*

Subpopulation	**Sea ice metrics†**		
	Change in spring ice retreat (days per decade)	**Change in fall ice advance (days per decade)**	**Change in summer sea ice area (percent change per decade)**
Arctic Basin	-3.2	8.0	-6.7
Baffin Bay	-7.3	5.2	-18.9
Barents Sea	-16.6	24.2	-16.0
Chukchi Sea	-3.4	4.2	-18.8
Davis Strait	-7.7	9.7	-19.9
East Greenland	-6.2	5.5	-6.5
Foxe Basin	-5.3	5.8	-14.2
Gulf of Boothia	-6.9	8.3	-12.2
Kane Basin	-7.2	5.6	-12.2
Kara Sea	-9.2	7.6	-18.6
Lancaster Sound	-5.6	5.1	-7.7
Laptev Sea	-8.2	6.5	-14.7
M'Clintock Channel	-3.9	5.8	-9.0
Northern Beaufort Sea	-5.8	3.3	-5.9
Norwegian Bay	-1.3	4.3	-2.3
Southern Beaufort Sea	-8.7	8.7	-20.5
Southern Hudson Bay	**-3.1**	**4.1**	**-11.4**
Viscount Melville Sound	-4.7	7.4	-6.1
Western Hudson Bay	-5.2	3.6	-16.3

† Sea ice metrics defined as follows by PBSG: (1) Change in date of spring sea ice retreat and change in date of fall sea ice advance (days per decade) over the period 1979-2014. Each year the area of sea ice reaches a maximum in March and a minimum in September. In order to measure the timing of the seasonal change in sea ice, we find the date each spring when the area of sea ice has dropped to a specific threshold and the date each fall when the area has grown back to that same threshold. The region-specific threshold is halfway (50%) between the mean March sea-ice area and the mean September sea-ice area over the period 1979-1988 for each subpopulation region. (2) Change in summer sea ice area (percent change/decade, June 1 – October 31) relative to the average summer sea ice area during 1979-1988. Sea ice area was calculated as the sum, over all grid cells with >15% sea ice concentration, of the grid cell area multiplied by the grid cell sea ice concentration.

6. Literature Cited

Atkinson, S. N., J. Boulanger, M. Campbell, V. Trim. J. Ware and A. Roberto-Charron. 2022. Aerial survey of the Western Hudson Bay polar bear subpopulation 2021. Final Report. Government of Nunavut, Department of Environment, Wildlife Research Section, Status Report 2022-xx, Igloolik, NU. XX pp + x Supplements.

Berkes, F. 2009. Evolution of co-management: role of knowledge generation, bridging organizations and social learning. Journal of Environmental Management 90: 1692–1702.

Cattet, M.R.L., Caulkett, N.A., Obbard, M.E., and Stenhouse, G.B. 2002. A body-condition index for ursids. Canadian Journal of Zoology 80: 1156–1161. doi: 10.1139/z02-103.

Crompton A. E., Obbard M. E., Petersen S. D., and Wilson P. J. 2008. Population genetic structure in polar bears (*Ursus maritimus*) from Hudson Bay, Canada: Implications of future climate change. Biological Conservation 141: 2528–2539.

CWS [Canadian Wildlife Service]. 2009. 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 by the Canadian Wildlife Service. Web Site: https://www.nwmb.com/en/public-hearings-a-meetings/public-hearings-1/2010-1/apr-13-15-2010-polar-bear-special-concern.

Dyck, M., Campbell, M., Lee, D.S., Boulanger, J., and Hedman, D. 2017. Aerial survey of the western Hudson Bay polar bear subpopulation 2016. 2017 Final Report. Government of Nunavut, Department of Environment, Wildlife Research Section, Igloolik, Nunavut, Canada, 82 pp.

EMRWB [Eeyou Marine Region Wildlife Board]. 2020. Cree knowledge of polar bears in the Eeyou Marine Region: A report based on information shared by Cree knowledge holders from the coastal communities of: Whapmagoostui, Chisasibi, Wemindji, Eastmain, and Waskaganish. 54 pp.

Hochheim K.P., and Barber D.G. 2014. An update on the ice climatology of the Hudson Bay system. Arctic, Antarctic, and Alpine Research 46: 66–83.

Jonkel, C., Smith, P., Stirling, I., and Kolenosky, G.B. 1976. The present status of the polar bear in the James Bay and Belcher Islands area. Canadian Wildlife Service Occasional Paper 26, 42 pp.

Kolenosky, G.B., Abraham, K.F., and Greenwood, C.J. 1992. Polar bears of southern Hudson Bay. Polar bear project, 1984-88. Final Report. Ontario Ministry of Natural Resources, Ontario, Canada, 107 pp.

Kolenosky, G.B., and Prevett, J.P. 1983. Productivity and maternity denning of polar bears in Ontario. International Conference for Bear Research and Management 5: 238–245.

Laforest, B.J., Hébert, J.S., Obbard, M.E., and Thiemann, G.W. 2018. Traditional Ecological Knowledge of polar bears in the northern Eeyou Marine Region, Québec, Canada. Arctic 71: 40–58.

Lunn, N.J., Branigan, M., Breton-Honeyman, K., Carpenter, L., Dyck, M., Gilbert, G., Goudie, J., Hedman, D., Keenan, E., Lee, D., Maher, A., Maraj, R., Obbard, M.E., Pisapio, J., Pokiak, F., Staples, L., and Szor, G. 2018. Management of polar bears in Canada, 2009-2016. Pages 33–67 *in* Durner, G.M., Laidre, K.L., and York, G.S. (eds.) Polar Bears: Proceedings of the Eighteenth Working Meeting of the IUCN/SSC Polar Bear Specialist Group. SSC Occasional Paper No. 63, IUCN, Gland, Switzerland and Cambridge, UK.

Lunn, N.J., Branigan, M., Carpenter, L., Chaulk, K., Doidge, B., Galipeau, J, Hedman, D., Huot, M., Maraj, R., Obbard, M., Otto, R., Stirling, I., Taylor, M., and Woodley, S. 2006. Polar bear management in Canada 2001-2004. Pages 41–52 *in* Aars, J., Lunn, N.J., and Derocher, A.E. (eds.) Polar Bears: Proceedings of the Fourteenth Working Meeting of the IUCN/SSC Polar Bear Specialist Group. SSC Occasional Paper No. 32, IUCN, Gland, Switzerland and Cambridge, UK.

McDonald, M., Arragutainaq, L., and Novalinga, Z. 1997. Voices from the Bay: The Traditional Ecological Knowledge of Inuit and Crees in the Hudson Bay Bioregion. Ottawa: CARC and the Environmental Committee of Sanikiluaq.

Middel, K.R. 2013. Movement parameters and space use for the Southern Hudson Bay polar bear subpopulation in the face of a changing climate. M.Sc. thesis, Trent University, Peterborough, Ontario, Canada.

NMRWB [Nunavik Marine Region Wildlife Board]. 2018. Nunavik Inuit Knowledge and Observations of Polar Bears: Polar bears of the Southern Hudson Bay subpopulation. Project conducted and report prepared for the NMRWB by Basterfield, M., Breton-Honeyman, K., Furgul, C., Rae, J., and O'Connor, M. Nunavik Marine Region Wildlife Board, Inukjuak, Québec, Canada, 73 pp.

Northrup, J.M., Howe, E., Lunn, N.J., Middel, K., Obbard, M.E., Ross, T.R., Szor, G., Walton, L., and Ware, J. 2022. 2021 Southern Hudson Bay polar bear subpopulation aerial survey: report to the 2023 meeting of the Canadian Federal-Provincial-Territorial Polar Bear Technical Committee, Québec City, Québec, 31 January-3 February. Unpublished Typescript, Ontario Ministry of Natural Resources, Peterborough, 52 pp.

Obbard, M.E. 2008. Southern Hudson Bay polar bear project 2003–2005: Final report. Unpublished report, Wildlife Research and Development Section, Ontario Ministry of Natural Resources, Peterborough, Ontario, Canada, 64 pp.

Obbard, M.E., Cattet, M.R.L., Howe, E.J., Middel, K.R., Newton, E.J., Kolenosky, G.B., Abraham, K.F., and Greenwood, C.J. 2016. Trends in body condition in polar bears (*Ursus maritimus*) from the Southern Hudson Bay subpopulation in relation to changes in sea ice. Arctic Science 2: 15–32.

Obbard, M.E., McDonald, T.L., Howe, E.J., Regehr, E.V., and Richardson, E.S. 2007. Polar bear population status in southern Hudson Bay, Canada. U.S. Geological Survey Administrative Report, U.S. Department of the Interior, Reston, Virginia, USA, 34 pp.

Obbard, M.E., and Middel, K.R. 2012. Bounding the Southern Hudson Bay polar bear subpopulation. Ursus 23: 134–144.

Obbard, M.E., Stapleton, S., Middel, K.R., Thibault, I., Brodeur, V., and Jutras, C. 2015. Estimating the abundance of the Southern Hudson Bay polar bear subpopulation with aerial surveys. Polar Biology 38: 1713–1725.

Obbard, M.E., Stapleton, S., Szor, G., Middel, K.R., Jutras, C. and Dyck, M. 2018. Re-assessing abundance of Southern Hudson Bay polar bears by aerial survey: effects of climate change at the southern edge of the range. Arctic Science 4: 634–655.

Obbard, M.E., Thiemann, G.W., Peacock, E., and DeBruyn, T.D. 2010. Polar bears: Proceedings of the 15th Working Meeting of the IUCN/SSC Polar Bear Specialist Group, 29 June-3 July 2009, Copenhagen, Denmark, SSC Occasional Paper No. 43, IUCN, Gland, Switzerland and Cambridge, UK.

Obbard, M.E., and Walton, L.R. 2004. The importance of Polar Bear Provincial Park to the Southern Hudson Bay polar bear population in the context of future climate change. Pages 105–116 *in* Rehbein, C.K., Nelson, J.G., Beechey, T.J., and Payne, R.J. (eds.) Parks and Protected Areas Research in Ontario, 2004: Planning Northern Parks and Protected Areas. Proceedings of the Parks Research Forum of Ontario (PRFO) Annual General Meeting, May 4–6, 2004. Parks Research Forum of Ontario, Waterloo, Ontario, Canada.

Ontario Ministry of Natural Resources. 1980. Polar Bear Provincial Park. Master Plan. Ontario Ministry of Natural Resources, Toronto, Ontario.

Ontario Ministry of Natural Resources. 2008. State of resources reporting: Polar bears in Ontario. Web site: https://www.ontario.ca/page/polar-bears.

PBSG [IUCN/SSC Polar Bear Specialist Group]. 2018. 2016 Status report on the world's polar bear subpopulations. Pages 1–32 *in* Durner, G.M., Laidre, K.L., and York, G.S. (eds.) Polar Bears: Proceedings of the Eighteenth Working Meeting of the IUCN/SSC Polar Bear Specialist Group. SSC Occasional Paper No. 63, IUCN, Gland, Switzerland and Cambridge, UK.

Sanikiluaq Hunter's and Trapper's Organization 2018. Submission to the Nunavut Wildlife Management Board Public Hearing in response to the Government of Nunavut Polar Bear

Management Plan. Web site: https://www.nwmb.com/en/public-hearings-a-meetings/public-hearings-1/2018.

Statistics Canada. 2023. (table). Census Profile. 2021 Census of Population. Statistics Canada Catalogue no. 98-316-X2021001. Ottawa. Released March 29, 2023. https://www12.statcan.gc.ca/census-recensement/2021/dp-pd/prof/index.cfm?Lang=E (accessed September 20, 2023)

Stern, H.L., and Laidre, K.L. 2016. Sea-ice indicators of polar bear habitat. The Cryosphere 10: 2027–2041.

Stirling, I., Thiemann, G.W., and Richardson, E. 2008. Quantitative support for a subjective fatness index for immobilized polar bears. Journal of Wildlife Management 72: 568–574.

Tonge, M.B., and Pulfer, T.L. 2011. Recovery strategy for polar bear (*Ursus maritimus*) in Ontario. Ontario Recovery Strategy Series. Prepared for the Ontario Ministry of Natural Resources, Peterborough, Ontario.

Viengkone, M., Derocher, A.E., Richardson, E.S., Malenfant, R.M., Miller, J.M., Obbard, M.E., Dyck, M.G., Lunn, N.J., Sahanatien, V., and Davis, C.S. 2016. Assessing polar bear (*Ursus maritimus*) population structure in the Hudson Bay region using SNPs. Ecology and Evolution 6: 8474–8484.

Viengkone, M., Derocher, A.E., Richardson, E.S., Obbard, M.E., Dyck, M.G., Lunn, N.J., Sahanatien, V., Robinson, B.G., and Davis, C.S. 2018. Assessing spatial discreteness of Hudson Bay polar bear populations using telemetry and genetics. Ecosphere 9(7) doi:10.1002/ecs2.2364.

Wiig, Ø., Atkinson, S.N., Born, E.W., Stapleton, S., Arnold, T., Dyck, M., Laidre, K.L., Lunn, N.J., and Regehr, E.V. 2022. An on-ice aerial survey of the Kane Basin polar bear (*Ursus maritimus*) subpopulation. Polar Biology 45: 89–100.

7. Appendices

Appendix A: 2011 Voluntary Agreement

CONSENSUS FROM THE
SOUTHERN HUDSON BAY POLAR BEAR MANAGEMENT MEETING
INUKJUAK, 21 SEPTEMBER 2011

On 20-22 September 2011, Hunters, Inuit and Cree organizations and wildlife management boards, and governments involved in the management of the Southern Hudson Bay polar bear subpopulation met in Inukjuak (see attached agenda).

1. All participants agree to a temporary voluntary limit to the Southern Hudson Bay polar bear take (including subsistence hunting and defense kills) to be implemented for the 2011/12 hunting season:

    - 26 for Nunavik Inuit, and 4 for Cree of Eeyou Istchee;
    - 25 for Nunavut;
    - 5 for the six coastal Cree Nations of Ontario.

These limits should be considered in the context of a flexible quota system as implemented under the Memorandum of Understanding between Sanikiluaq and the Nunavut Government.

2. All participants commit to consider changes in 2012, following the review of all new sources of information, including but not limited to the 2011 and 2012 aerial survey results and traditional knowledge, whether this means increased or decreased harvest levels.

3. All participants welcome the hunter desire to set a long term management plan and stand ready to assist as needed, including the establishment of a flexible quota system and/or any other means that are deemed appropriate.

3. All participants welcome the hunter desire to set a long term management plan and stand ready to assist as needed, including the establishment of a flexible quota system and/or any other means that are deemed appropriate.

4. All participants agree to maintain close communication and collaboration regarding the management and the design of appropriate research for polar bears.

5. The relevant governments/institutions will ensure adequate reporting and registration systems of harvested bears are in place. Hunters commit to accurately report the take of bears on a timely basis, including pertinent biological information necessary for management purposes.

Appendix B: 2014 Voluntary Agreement

CONSENSUS FROM THE
SOUTHERN HUDSON BAY POLAR BEAR MANAGEMENT MEETING
OTTAWA, 27 SEPTEMBER 2014

On 25-27 September 2014, hunters, Inuit and Cree organizations and governments involved in the management of the Southern Hudson Bay polar bear subpopulation met in Ottawa and came to an agreement.

This agreement is in effect from November 2014 until November 2016 and is applicable to the take of polar bears in accordance with the respective hunting seasons of each jurisdiction.

Meeting participants recognize the important commitment of hunters to the conservation and sustainable use of polar bears. Moreover, participants commend the significant compromises made by respective aboriginal stakeholders in achieving this voluntary agreement.

Participants recognize the importance of improving the way that aboriginal traditional knowledge and science are brought together to support decision-making for the management and conservation of polar bears.

1. Participants agree to the following voluntary limits to the annual take (including subsistence hunting and defense kills) of Southern Hudson Bay polar bears to be implemented for the 2014/15 and 2015/16 hunting seasons.

- 22 for Nunavik Inuit;
- 20 for Nunavut Inuit;
- 3 in total for Ontario and Quebec Cree, with alternating division per harvest season starting with 1 for the Quebec Cree and 2 for the Ontario Cree.

These limits should be implemented in the context of sex-selective harvest and a flexible quota system, where applicable.

In November 2016, the relevant parties will meet to review this agreement.

2. Participants support the undertaking of additional scientific and traditional knowledge studies at the earliest possible opportunity to

inform future management decisions, and encourage the funding for this work from relevant organizations.

3. Participants agree to maintain close communication and collaboration regarding the implementation of this agreement (including achieving the voluntary limits and relevant interjurisdictional arrangements), the design of appropriate research and monitoring for polar bears, and the sharing of information relevant to management decision-making.

4. The wildlife management authorities, including those established under the various Land Claims Agreements, are encouraged to coordinate their decision-making (e.g. through inter-jurisdictional joint hearings).

5. Participants commit to the full and timely reporting of all human-caused mortality of polar bears, including in defense of life or property, and to ensuring that registration systems of harvested bears are in place. Reporting shall include pertinent biological information necessary for management purposes.

6. Participants recognize Environment Canada's jurisdiction for international export decisions related to Southern Hudson Bay polar bears, and that the content of this agreement will be one source informing these decisions.

7. This voluntary agreement is without prejudice to other agreements pertaining to the harvest of polar bears, or to the decision-making processes defined in the applicable land claims agreements.

8. All of the above is subject to consultation with affected stakeholders.

9. Agreed by:
   Nunavut Department of Environment
   Nunavut Tunngavik Incorporated
   Makivik Corporation
   Ontario Ministry of Natural Resources and Forestry
   Cree Trappers Association (Quebec)
   Fort Severn Cree Nation
   Cree Nation Government (Quebec)
   Environment Canada

Sanikiluaq Hunters and Trappers Organization
Inukjuak Nunavimmi Umajulirijiit Katujjiqatigiinninga
Kuujjuarapik Nunavimmi Umajulirijiit Katujjiqatigiinninga
Umiujaq Nunavimmi Umajulirijiit Katujjiqatigiinninga
Qikiqtaaluk Wildlife Board

10. Representatives from the following groups were not present at the meeting but will be invited to endorse the agreement by 10 October 2014:
Ministère des forêts, de la faune et des parcs de Québec
Regional Nunavimmi Uumajulirijiit Katutjiqatigiinninga
Hunting, Fishing, Trapping Coordinating Committee

11. Representatives from the following groups were not present at the meeting but will be encouraged to be involved:
Fort Albany First Nation
Kashechewan First Nation
Moose Cree First Nation
Weenusk First Nation at Peawanuck
Attawapiskat First Nation