# 2021 Polar Bear Technical Committee Status Table and Supporting Information

***Last updated 21 June 2021***

## Contents

# 2021 PBTC Status Table Terms

**1. Purpose**

Under its Terms of Reference, the Polar Bear Technical Committee (PBTC) is to provide an annual report to the Polar Bear Administrative Committee (PBAC) on the status of each of Canada's 13 sub-populations of polar bears that is based upon the best available scientific information and Traditional Ecological Knowledge.

This document defines the various terms used in the Status Table and the basis on which the status of each sub-population was assessed by the PBTC in February 2021.

**2. Definitions**

2.1 Population Estimate

The most recent estimate of abundance as assessed by the PBTC.

2.2 Historic Trend

Historic trend is the PBTC's assessment of changes in abundance that a sub-population may have experienced since the signing of the international Agreement on the Conservation of Polar Bears (1973), which led to current management practices and research. The most recent population estimate and the first comparable documented historic estimate are examined. If a direct comparison of abundance estimates cannot be made or there is only a single estimate of abundance, other lines of evidence may be used in this assessment.

2.3 IK Assessment

The Polar Bear Technical Committee (PBTC) takes into consideration Indigenous Knowledge (IK) in the assessments of the status table. The Committee applies a definition of Indigenous Knowledge similar to the definition of Traditional Ecological Knowledge (TEK) adopted by the Polar Bear Range States:

Indigenous Knowledge (IK) refers to a cumulative body of knowledge about the relationships of living beings with one another and with their environment, which is generated from the cultural practices, lived experiences and traditions of local and Indigenous Peoples.

PBTC weighs the value of IK information according to the rigor of study methodology, execution and analysis and the professional experience and judgments of traditional knowledge holders.2.4

2.4 Recent Trend (15 Years Ago to Present)

Recent trend is the PBTC's assessment of the direction of abundance over the last 15 years. The objective of this assessment is to inform the PBAC as to whether a sub-population has increased, decreased, or remained stable. Recent trend is assessed by comparing the most recent population estimate to the previous population estimate. If a direct comparison of population estimates cannot be made or is not applicable, other lines of evidence such as population viability analyses, productivity indicators, and recent harvest pressure may be used to infer any changes in recent abundance.

2.5 Historic Annual Removals

The average annual removals reported, which should include all human-caused mortalities and removals to zoos.

2.6 Potential Maximum Removals

The annual total number of human-caused polar bear mortalities from a sub-population allowed under quota(s), Total Allowable Harvest, Total Allowable Take, and\or voluntary agreements. Potential maximum removals do not include credits applied for and approved under the flexible quota system in Nunavut.

**3. Historic Trend Assessment**

3.1 Steps to Assess Historic Trend

Compare current population estimate with the first documented and comparable historic population estimate. When a current estimate is directly comparable to an historic estimate, a designation without any qualifier (i.e. reduced, stable, or increased) may be used.

If the current estimate is not directly comparable to an historic estimate because of differences in study area, or methods, a comparison may be made but any assessment of changes in abundance are inferred. In this case, a qualifier is required (i.e. likely reduced, likely stable, or likely increased).

When population estimates cannot be compared or the comparison does not allow to establish a statistically significant difference between the estimates, other lines of evidence such as the most recent population attributes of the sub-population (e.g. age structure) may be used to infer changes in the abundance of the sub-population. This does not include IK. Again, a qualifier is required (i.e. likely reduced, likely stable, or likely increased).

When there is insufficient information or lack of confidence in available information to make an assessment of change in abundance, the sub-population is assessed as uncertain.

Additional text is provided in the comments section of the status table. It includes listing items such as major threats and other lines of evidence that may have been used.

3.2 Status Designations

| | |
|---|---|
| Reduced | Current population estimate is statistically significantly lower than historic population estimate |
| Stable | Current population estimate is not different from historic population estimate |
| Increased | Current population estimate is statistically significantly higher than historic population estimate |
| Likely Reduced | Current or inferred current population abundance is lower than historic or inferred historic population abundance |
| Likely Stable | Current or inferred current population abundance is not different from historic or inferred historic population abundance |

| | |
|---|---|
| Likely Increased | Current or inferred current population abundance is higher than historic or inferred historic population abundance |
| Uncertain | Insufficient information or lack of confidence in available information to make an assessment |

**4. IK assessment**

4.1 Steps for IK-based Assessment of Status

Consider the observations, propositions, and theories ("OPT" – the bundle of elements that contribute to and constitute IK) of Indigenous Knowledge Holders ("IKHs") to contribute to the assessment the current status of each management unit. Wherever possible the IK Assessment is based on the present to past 15-year timeframe, for consistency with the Recent Trend Column. However, given the nature of IK acquisition and transmission, the IK Assessment may extend beyond the most recent 15-year period, but within the lived experience and living memory of the IKHs. The OPT are a basis to make inferences related to assessment of future trend.

Assessment of status may include a full suite of population attributes collected from IKHs (e.g. population abundance, indicators of population productivity and viability, age, distribution, den locations, behaviour).

Compare the current IK-based population assessment of status with previous IK-based assessments (within a 10-20 year period). When a current assessment is directly comparable to a previous population assessment utilizing a consistent data collection protocol and methodology, a designation without any qualifier is made (i.e. reduced, stable or increased).

If the current assessment of status is not directly comparable to the previous population assessment because of differences in study area, population attributes, methods, or is outdated, a comparison may still be made as the basis for inference. Changes from the previous assessment may include qualification (i.e. likely reduced, likely stable, or likely increased).

When there is insufficient information or lack of confidence in available information to make an assessment of changes in status, the sub-population is assessed as uncertain.

4.2 IK based trend assessment designations

| | |
|---|---|
| Decline | There is a high degree of confidence that the current population status assessment is lower than previous population assessment |
| Stable | Current population status assessment is not different from previous population assessment |
| Increase | There is a high degree of confidence that the current population status assessment is higher than previous population assessment |
| Likely Decline | Current or inferred current population assessment is lower than previous or inferred previous population assessment |
| Likely Stable | Current or inferred current population assessment is not different from previous or inferred previous population assessment |

| | |
|---|---|
| Likely Increase | Current or inferred current population assessment higher than previous or inferred previous population assessment |
| Uncertain | Insufficient information or lack of confidence in available information to make an assessment |

**5. Recent Trend Assessment**

5.1 Steps to Assess Recent Trend

Compare current population estimate with previous population estimate assuming current population estimate is recent. When a current estimate is directly comparable to its previous population estimate, a designation without any qualifier may be made (i.e. reduced, stable, or increased).

If the current estimate is not directly comparable to its previous population estimate because of differences in study area, methods, or is outdated, a comparison may be made but any assessment of changes in recent population abundance are inferred and a qualifier is required (i.e. likely reduced, likely stable, or likely increased).

In the absence of a statistically significant difference between two population estimates, or when population estimates cannot be compared or are not applicable to assess recent trend, other lines of evidence that could provide insight to the status of the population (e.g. age distribution or body condition), may be used to infer any changes in the abundance of the sub-population. This does not include IK. Again, a qualifier is required (i.e. likely reduced, likely stable, or likely increased).

When there is insufficient information or lack of confidence in available information to make an assessment of changes in population abundance, the sub-population is assessed as uncertain.

Additional text is provided in the comments section of the status table. It includes listing items such as major threats and other lines of evidence that may have been used.

5.2 Recent Trend Designations

| | |
|---|---|
| Declined | Population estimate is statistically significantly lower than previous population estimate |
| Stable | Current population estimate is not different from previous population estimate |
| Increased | Current population estimate is statistically significantly higher than previous population estimate |
| Likely Declined | Current or inferred current population abundance is lower than previous or inferred previous population abundance |
| Likely Stable | Current or inferred current population abundance is not different from previous or inferred previous population abundance |
| Likely Increased | Current or inferred current population abundance is higher than previous or inferred previous population abundance |

| | |
|---|---|
| Uncertain | Insufficient information or lack of confidence in available information to make an assessment |

# 2021 PBTC Status Table

| Subpopulation | Population Estimate | ±2 SE or 95% CI | Year of Population Estimate | Method† | Historic Trend | Indigenous Knowledge Assessment | Recent Trend (scientific) | Historic annual removal (5-yr mean)‡ | Historic annual removal (3-yr mean)‡ | Historic annual removal (2019/2020)‡ | Potential Maximum Removals (2019-2020)# | Comments | Jurisdiction# |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Baffin Bay (BB) | 2,826 | 2059-3593 | 2012-13[1] | GM/R | uncertain | stable[2] | likely stable[3] (1997 to 2013) | 142.4 | 146.3 | 144 | 160 (NU:80+GL:80) | Cannot make direct comparison of previous (1997) and current (2012-2013) estimate because of differences in geographical coverage and distribution of bears; decline in sea ice; increased time spent on land; decline in body condition; reduced denning time; increased marine traffic; harvest risk assessment completed. | GL, NU |
| Davis Strait (DS) | 2,158 | 1833-2542 | 2007[4] | PM/R | likely increased | increased[5] | likely increased[6] (1980 to 2007) | 67.6 | 67.0 | 77 | QC + 76 (NU:61+NL:12+GL:3) | Potential for high harvest (currently managed in Nunavut for a population reduction; quota is not in place in Quebec/NMR); 2019/20 change in managed harvest sex ratio in Nunavut could reduce population growth rate; decline in sea ice; currently being reassessed. | GL, NL, NU, QC |
| Foxe Basin (FB) | 2,585 | 2096-3189 | 2009-10[7] | A | stable | increased[8] | stable[9] (1997 to 2010) | 109.0 | 113.3 | 110 | QC + 123 (NU: 123) | Decline in sea ice; potential for high harvest (quota is not in place in Quebec/NMR; 2019/20 change in managed harvest sex ratio in Nunavut could reduce population growth rate. | NU, QC |
| Gulf of Boothia (GB) | 1,525 | 949-2101 | 2015-17[40] | GM/R | likely stable | increased[11] | Stable (2000 to 2017) | 65.2 | 66.7 | 70 | 74 (NU:74) | Current and projected habitat change may affect productivity of ecosystem; healthy productivity; 2019/20 change in managed harvest sex ratio in Nunavut could reduce population growth rate; potential for increased summer tourism shipping. | NU |
| Kane Basin (KB) | 357 | 221-493 | 2013-14[13] | GM/R | likely reduced | increased[14] | increased[15] (1997 to 2014) | 8.6 | 7.0 | 10 | 11 (NU:5+GL:6) | Small population; adult male survival 0.87 and female survival 0.95; changes in sea ice conditions (multi-year to seasonal sea ice); potential positive response to initial impacts of climate change and reduced harvest; harvest risk assessment completed. | GL, NU |
| Lancaster Sound (LS) | 2,541 | 1759-3323 | 1995-97[16] | PM/R | likely stable | increased[17] | uncertain[18] | 77.8 | 73.3 | 70 | 85 (NU:85) | Sea ice decline; potential for increased summer tourism and commercial shipping; proposed Tallurutiup Imanga National Marine Conservation Area; 2019/20 change in managed harvest sex ratio in Nunavut could reduce population growth rate; reassessment planned to begin in 2021. | NU |
| M'Clintock Channel (MC) | 716 | 545-955 | 2014-16[41] | GM/R | uncertain | stable[20] | Increased (2000 to 2016) | 9.8 | 9.3 | 7 | 12 (NU:12) | Changes in sea ice conditions (multi-year to annual sea ice); potential for increased summer tourism shipping; 2019/20 change in managed harvest sex ratio in Nunavut could reduce population growth rate. IK report in progress. | NU |

| Subpopulation | Population Estimate | ±2 SE or 95% CI | Year of Population Estimate | Method† | Historic Trend | Indigenous Knowledge Assessment | Recent Trend (scientific) | Historic annual removal (5-yr mean)‡ | Historic annual removal (3-yr mean)‡ | Historic annual removal (2019/2020)‡ | Potential Maximum Removals (2019-2020)# | Comments | Jurisdiction# |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Northern Beaufort Sea (NB) | 1,291 | none estimated | 2006[22] | PM/R | likely stable | stable[23] | likely stable[24] (1987 to 2006) | 37.8 | 33.3 | 25 | 77 (NU:6+NWT:71) | Changes in sea ice conditions (multi-year to annual sea ice); low harvest due to poor ice conditions for travel and low harvest pressure; new boundary formally accepted in 2013; abundance currently being reassessed. Potential allowable removals based upon corrected population estimate for management in NT of 1,711. | NWT, NU |
| Norwegian Bay (NW) | 203 | 115-291 | 1997[25] | PM/R | uncertain | stable[26] | uncertain[27] | 1.2 | 1.0 | 0 | 4 (NU:4) | Small, isolated population with low harvest pressure; reassessment planned to begin in 2021. | NU |
| Southern Beaufort Sea (SB) | 1,215 | none estimated | 2006[28] | PM/R | uncertain | stable[29] | likely declined[30] (1998 to 2006) | 22.0 | 19.0 | 15 | 56 (US:35 + ISR:21) | Declines in body condition, growth and demographic parameters related to sea ice declines; eastern subpopulation boundary was adjusted in 2013/14; IK suggests that as sea ice melts in the Southern Beaufort Sea polar bear distribution will shift northward; potential for increase in oil/gas development in Alaska; currently being reassessed. | NWT/YK, US |
| Southern Hudson Bay (SH) | 780 | 590-1029 | 2016[31] | A | likely reduced | stable James Bay; likely increase in East Hudson Bay[32] | likely declined[33] (2012 to 2016) | 34.6 | 34.7 | 33 | ON + QC + 48 (NU:25+NMR:23) | Science indicates large decreases in body condition and survival rates in association with sea ice declines; decline of permafrost-based denning habitat; IK indicates winter body condition has not changed and that reproductive rates have improved. 2019/20 change in managed harvest sex ratio in Nunavut could reduce population growth rate; incomplete reporting of human-caused mortality in some jurisdictions; harvest quota reassessment process underway. | NU, ON, QC |
| Viscount Melville Sound (VM) | 161 | 93-229 | 1992[34] | PM/R | likely reduced | increased[35] | uncertain[36] | 2.2 | 1.3 | 0 | 7 (NU:3+NWT:4) | Changes in sea ice conditions (multi-year to annual sea ice); small, isolated population with low harvest pressure; currently being reassessed. | NWT, NU |
| Western Hudson Bay (WH) | 842 | 562-1121 | 2016[37] | A | likely reduced | increase[38] | likely declined[39] (2011 to 2016) | 29.8 | 31.0 | 20 | MB + 38 (NU:38) | Science indicates sea ice decline, declines in body condition; lower productivity compared to adjacent FB and SH subpopulations; linkage between female survival and sea-ice conditions; Nunavut TAH based on assumption that Manitoba's mean annual removal will continue to be 4. 2019/20 change in managed harvest sex ratio in Nunavut could reduce population growth rate. | MB, NU |

**Notes**

† Abbreviations for survey methodology: PM/R - Physical Mark Recapture Survey; GM/R - Genetic Mark Recapture Survey; A - Aerial survey

‡ The 5-year, 3-year, and most recent year values for removals include all human-caused mortality and include removals from jurisdictions harvesting both under wildlife board-established annual quotas and without quotas

# Abbreviations used for jurisdictional entities: GL – Greenland; MB – Manitoba; NL – Newfoundland and Labrador; NU – Nunavut; NWT – Northwest Territories: ON – Ontario; QC – Quebec; US – United States; YK – Yukon Territory; ISR – Inuvialuit Settlement Region; NMR – Nunavik Marine Region

* The revised estimates for NB and SB are the result of a subpopulation boundary change. Revision is based on an analysis by Griswold et al. (2017).

**Additional footnotes**

1. SWG 2016
2. Born et al. 2011; Dowsley 2005; Dowsley 2007; Dowsley and Taylor 2006a; Nunavut Wildlife Management Board (NWMB) Public Hearing minutes and submissions for April 2008, September 2009;
3. SWG 2016
4. Peacock et al. 2013
5. Kotierk 2010a, 2010b; York et al. 2015 recognizing spatial limitations of work restricted to Labrador.
6. Peacock et al. 2013; Stirling et al. 1980.
7. Stapleton et al. 2016
8. Canadian Wildlife Service Nunavut consultation report 2009; Dyck personal comment 7 Feb 2013; Sahanatien personal comment 7 Feb 2013;
9. Stapleton et al. 2016; Taylor et al. 2006b
10. Taylor et al. 2009
11. Canadian Wildlife Service Nunavut consultation report 2009; Keith et al. 2005
12. Vital Rates are from 2000 (Taylor et al. 2009) and are considered too old/unreliable for PVA
13. SWG 2016
14. Canadian Wildlife Service Nunavut consultation report 2009
15. SWG 2016
16. Schweinsburg et al. 1980; Taylor et al. 2008
17. Canadian Wildlife Service Nunavut consultation report 2009
18. For the period 1997-2012, the population would be expected to be stable under the historical harvest regimen (1993-97). At the mean harvest rate of 78 bears/yr (2002-2006), and based on a PVA, we estimate that the population is more likely to decline than to increase (Taylor et al. 2008). Current harvest rate should also lead to decline, but no recent vital rates have been collected to update the PVA
19. Taylor et al. 2006a
20. Inuit report that bears are moving to neighbouring areas throughout the region. (CWS Nunavut consultation report 2009; Keith et al. 2005)
21. Likely an increase based on quantitative assessment of growth rate (Taylor et al. 2006a)
22. Griswold et al. 2017; Stirling et al. 2011
23. Joint Secretariat 2015
24. Population size used for management was historically adjusted to 1,200 due to bias in in population estimate (Amstrup et al. 2005; Stirling et al. 2011).
25. Taylor et al. 2006a; Taylor et al. 2008
26. Canadian Wildlife Service Nunavut consultation report 2009
27. Vital rates for Riskman PVA are 20 years old and vital rates were substituted from other populations (Taylor et al 2008); no recent work in the area
28. Bromaghin et al. 2015 ; Griswold et al. 2017; USFWS 2010
29. Joint Secretariat. 2015
30. Population estimate is lower but not statistically different from previous population estimates (Amstrup et al. 1986, Regehr et al. 2006). Quotas were based on the understanding that the total harvest of independent females would not exceed the modelled sustainable maximum of 1.5% of the population (Taylor et al. 1987) and that a 2:1 ratio of males to females would be maintained in the total quota harvested (Stirling 2002)
31. Obbard et al. 2018
32. NMRWB Inuit Knowledge Study 2018, NMRWB Public Hearing Inukjuak February 2014
33. Based on comparison with previous subpopulation estimates (Obbard et al. 2018; Obbard et al. 2016; Obbard et al. 2013; Obbard 2008; Kolenosky 1994).
34. Taylor et al. 2002
35. Canadian Wildlife Service Nunavut consultation report 2009; community consultations in 2012 and 2013
36. Harvest managed for population growth since last survey including a 5 year moratorium; comparable litter size in 2012 (GNWT unpublished)
37. Dyck et al. 2017; see Lunn et al. 2016 mark recapture estimate
38. Canadian Wildlife Service Nunavut consultation report 2009, Kotierk 2012, NWMB Public Hearing minutes 2005, 2011, 2014, 2017; Tyrrell 2006
39. Stapleton et al. 2014; Lunn et al. 2016; Dyck et al. 2017
40. Dyck et al. 2020a
41. Dyck et al. 2020b

# 2021 PBTC Removals Table

**2015/2016 – 2019/2020 RECORDED HUMAN-CAUSED MORTALITY IN POLAR BEAR POPULATIONS IN AND SHARED WITH CANADA COMPILED FOR 2021 PBTC MEETING**

| Population | Jurisdiction | 2015-16 | | | | 2016-17 | | | | 2017-18 | | | | 2018-19 | | | | 2019-2020 | | | | 5 year mean | 3 year mean | Most recent year | | N est.* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | KILL | F | M | U | KILL | F | M | U | KILL | F | M | U | KILL | F | M | U | KILL | F | M | U | Harvest | Harvest | Harvest | Proportion Female | |
| BB | NU | 63 | 21 | 42 | 0 | 64 | 20 | 44 | 0 | 65 | 30 | 35 | 0 | 73 | 34 | 39 | 0 | 74 | 33 | 41 | 0 | 142.4 | 146.3 | 144 | 0.410 | 2826 |
| BB | GL | 73 | | | 73 | 73 | | | 73 | 79 | | | | 78 | 32 | 46 | 0 | 70 | 26 | 44 | 0 | | | | | |
| DS | NU | 32 | 11 | 21 | 0 | 43 | 16 | 27 | 0 | 38 | 18 | 20 | 0 | 31 | 10 | 21 | 0 | 50 | 20 | 30 | 0 | 67.6 | 67.0 | 77 | 0.413 | 2158 |
| DS | NL | 13 | 4 | 9 | 0 | 13 | 4 | 9 | 0 | 12 | 3 | 9 | 0 | 10 | 4 | 6 | 0 | 11 | 3 | 8 | 0 | | | | | |
| DS | QC | 18 | 7 | 11 | 0 | 18 | 6 | 12 | 0 | 12 | 5 | 7 | 0 | 21 | 2 | 19 | 0 | 13 | 7 | 6 | 0 | | | | | |
| DS | GL | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | | 0 | 0 | 0 | 0 | 3 | 1 | 0 | 2 | | | | | |
| FB | NU | 97 | 36 | 61 | 0 | 96 | 29 | 67 | 0 | 104 | 36 | 68 | 0 | 114 | 42 | 72 | 0 | 110 | 40 | 70 | 0 | 109.0 | 113.3 | 110 | 0.364 | 2580 |
| FB | QC | 9 | 2 | 5 | 2 | 3 | 1 | 2 | 0 | 5 | 3 | 2 | 0 | 7 | 4 | 3 | 0 | 0 | 0 | 0 | 0 | | | | | |
| GB | NU | 65 | 22 | 43 | 0 | 61 | 22 | 39 | 0 | 64 | 21 | 43 | 0 | 66 | 22 | 44 | 0 | 70 | 26 | 44 | 0 | 65.2 | 66.7 | 70 | 0.371 | 1592 |
| KB | NU | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 8.6 | 7.0 | 10 | 0.300 | 357 |
| KB | GL | 11 | | | 11 | 11 | | | 11 | 7 | | | | 4 | 2 | 2 | 0 | 10 | 3 | 7 | 0 | | | | | |
| LS | NU | 91 | 24 | 67 | 0 | 78 | 17 | 61 | 0 | 70 | 20 | 50 | 0 | 80 | 25 | 55 | 0 | 70 | 23 | 47 | 0 | 77.8 | 73.3 | 70 | 0.329 | 2541 |
| MC | NU | 11 | 5 | 6 | 0 | 10 | 0 | 10 | 0 | 10 | 2 | 8 | | 11 | 5 | 6 | 0 | 7 | 1 | 6 | 0 | 9.8 | 9.3 | 7 | 0.143 | 284 |
| NB | NWT | 49 | 20 | 28 | 1 | 40 | 10 | 29 | 1 | 42 | 11 | 29 | 2 | 31 | 11 | 19 | 1 | 25 | 7 | 17 | 1 | 37.8 | 33.3 | 25 | 0.292 | 1291 |
| NB | NU | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | | | | | |
| NW | NU | 2 | 0 | 2 | 0 | 1 | 0 | 1 | 0 | 3 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1.2 | 1.0 | 0 | N/A | 203 |
| SB | NWT/YK | 9 | 4 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 8 | 3 | 5 | 0 | 0 | 0 | 0 | 0 | 22.0 | 19.0 | 15 | 0.143 | 1215 |
| SB | USA | 20 | 3 | 16 | 1 | 24 | 1 | 17 | 6 | 16 | 2 | 13 | 1 | 18 | 8 | 5 | 5 | 15 | 2 | 12 | 1 | | | | | |
| SH | NU | 20 | 6 | 14 | 0 | 20 | 7 | 13 | 0 | 28 | 12 | 16 | 0 | 23 | 8 | 15 | 0 | 23 | 6 | 17 | 0 | 34.6 | 34.7 | 33 | 0.300 | 780 |
| SH | ON | 2 | 0 | 1 | 1 | 2 | 0 | 1 | 1 | 0 | | | | 5 | 1 | 0 | 4 | 5 | 2 | 0 | 3 | | | | | |
| SH | QC | 19 | 9 | 10 | 0 | 6 | 1 | 5 | 0 | 5 | 1 | 4 | 0 | 10 | 2 | 8 | 0 | 5 | 1 | 4 | 0 | | | | | |
| VM | NWT | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2.2 | 1.3 | 0 | N/A | 161 |
| VM | NU | 2 | 1 | 1 | 0 | 3 | 1 | 2 | 0 | 3 | 1 | 2 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | | | | | |
| WH | NU | 32 | 18 | 14 | 0 | 19 | 6 | 13 | 0 | 32 | 7 | 25 | 0 | 37 | 19 | 18 | 0 | 19 | 3 | 16 | 0 | 29.8 | 31.0 | 20 | 0.200 | 842 |
| WH | MB** | 3 | 2 | 1 | 0 | 2 | 1 | 1 | 0 | 2 | 1 | 1 | 0 | 2 | 1 | 1 | 0 | 1 | 1 | 0 | 0 | | | | | |

Statistics represent a harvest season (July 1 to June 30)

* Abundance taken from 2021 PBTC Status Table

**Includes live removals

# 2021 PBTC Polar Bear Subpopulation Narratives

## Baffin Bay (BB)

### Status and delineation

Based on movements of adult females with satellite radio-collars and recaptures of tagged animals, the Baffin Bay subpopulation is bounded by the North Water Polynya to the north, Greenland to the east and Baffin Island, Canada to the west (Taylor and Lee 1995; Taylor *et al*. 2001; Laidre *et al*. 2013, 2018). A distinct southern boundary at Cape Dyer on Baffin Island in Nunavut, Canada is evident from the movements of tagged bears (Stirling *et al*. 1980; Peacock *et al*. 2012) and from polar bears monitored by satellite telemetry (Taylor *et al*. 2001; Laidre *et al*. 2018). This boundary overlaps with the northern boundary of the Davis Strait subpopulation. Studies of microsatellite genetic variation have not revealed significant differences between polar bears in BB and neighboring Kane Basin, although there was significant genetic variation between polar bears in BB and those in Davis Strait (Paetkau *et al*. 1999; Peacock *et al*. 2015; Malenfant *et al*. 2016; SWG 2016). However, polar bears in BB cluster with bears in northern Davis Strait (Peacock *et al*. 2015).

An initial subpopulation estimate of 300 – 600 bears in BB was based on mark-recapture data collected in spring (1984 – 1989) in which the capture effort was restricted to shore-fast ice and the floe edge off northeast Baffin Island. However, work in the early 1990s showed that an unknown proportion of the subpopulation was typically offshore during the spring and, therefore, unavailable for capture. A second study (1993 – 1997) was carried out during September and October, when all polar bears were thought to be ashore in summer retreat areas on Bylot and Baffin islands (Taylor *et al*. 2005). Taylor *et al*. (2005) estimated the number of polar bears in BB at 2,074 ± 226 (SE).

Before the introduction of a quota system in Greenland during 2006, it was believed that the combined Nunavut/Greenland harvest removals for BB were not sustainable. A 2004 computer PVA simulation estimated that the BB subpopulation abundance was around 1600 bears (Aars *et al*. 2006), and that the population was likely declining. As a response to this, the Canada-Greenland Joint Commission (JC) on Polar Bear was established in 2009 with the objectives to manage polar bears within Kane Basin and Baffin Bay and to ensure their conservation, as well as establishing effective management systems (SWG 2016). Due to the high uncertainty of the population status, which was caused in part by harvest uncertainties and changing environmental conditions, a phased-in reduction in harvest levels was recommended by the JC between 2010 and 2014 where Nunavut harvest levels were reduced from 105 bears annually in 2010, to 65 bears annually in 2014. One primary objective of the JC was also to conduct a new population study to up-date the status of the BB subpopulation.

A 3-year genetic mark-recapture survey (via biopsy darting) was completed in 2014 resulting in a new population estimate, survival rates, and habitat use analyses (SWG 2016). The mean estimate of total abundance of the BB subpopulation in 2012-2013 was 2,826 (95% CI = 2,059-3,593) polar bears. Due to evidence that the sampling design and environmental conditions resulted in an underestimate of abundance in the 1990s, these two estimates are not directly comparable and trend in abundance cannot be determined.

Satellite telemetry data and habitat selection studies in the 2000s indicate a number of ecological changes related to sea ice loss in Baffin Bay. There has been a significant reduction in the range of the subpopulation in all months and seasons when compared to the 1990s. The most marked reduction is a 60% decline in subpopulation range size in summer. Emigration from Baffin Bay has declined since the 1990s, especially with a reduction of bears moving from BB into Davis Strait and Lancaster Sound. The total number of bears marked during studies in 2011-2012 in BB was equivalent to ~34% of the estimated population size. Despite this, instances of emigration were ≤ 1% of the recaptures and recoveries of marks for the BB subpopulation.

Compared to the 1990s, adult female BB bears now use significantly lower sea-ice concentrations in winter and spring and spend 20-30 days longer on land on Baffin Island during the summer ice-free season (Laidre *et al*. 2018). Changes in maternity denning have been observed; entry dates into maternity dens are >1 month later in the 2000s than the 1990s. Furthermore, the first date of arrival on land of pregnant females is significantly earlier in the 2000s. Maternity dens in the 2000s occurred at higher elevations and steeper slopes than the 1990s, likely due to reduced snow cover (Escajeda *et al*. 2018)

### Harvest Management

BB polar bears are harvested by hunters from Nunavut and Greenland. A harvest risk assessment of the BB polar bear subpopulation was completed for the JC by the SWG to provide various harvest scenarios to guide management decisions (Regehr *et al*. 2017). The harvest risk analyses incorporated various demographic approaches and vital rates based on polar bear life history, and potential effects of future sea-ice conditions on polar bear population size and status through projected trends in carrying capacity. The JC decided on a low-to-medium risk tolerance for the BB polar bear subpopulation with a management objective of maintaining a subpopulation size that is in balance with the number of bears the environment can support. The new harvest levels for BB represent a total removal rate of 5.7%, or 160 bears per year, at an overall sex ratio of 1 male to 1 female, and which is divided evenly between Canada and Greenland.

### Protected Areas

Auyuittuq and Sirmilik National Parks on eastern Baffin Island, Canada attract visitors mainly for hiking and climbing. Both parks provide denning and summer habitat protection for BB polar bears. In Greenland, the Melville Bay Nature Reserve was created in 1980 in part to protect denning habitat. The reserve consists of an outer zone, where hunting is permitted and an inner zone in which all hunting is prohibited.

### Traditional Ecological Knowledge

Dowsley and Wenzel (2008) collected TEK of the BB subpopulation through semi-directed interviews. While they found significant differences in the responses among communities in Nunavut regarding whether there had been any change in the size of the subpopulation and numbers of bears in town, the majority of respondents in each community reported an increase. No respondent indicated a decrease in the subpopulation or a decrease in the numbers of bears in communities. Respondents also observed receding of the floe-edge towards land, and a decrease in the amount of land-fast ice in the region. Comments from the public at the Nunavut Wildlife Management Board (NWMB) April 2008 public meeting, including hunters and trappers and Nunavut Tunngavik Incorporated (NTI) support the findings of Dowlsey and Wenzel (2008).

In Greenland, an interview study carried out in 2006 (Born *et al.* 2011) reported an increased occurrence of polar bears close to the coast, polar bears being thinner, a decrease in sea ice cover and warmer, more unpredictable weather that influenced travelling and hunting activities, as well as an increased number of polar bears caught from skiffs, as compared to dog-sled (hunting polar bears from skidoos is forbidden in Greenland).

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## Davis Strait (DS)

### Status and delineation

Based on the recapture or harvest of previously tagged animals and tracking adult female polar bears with satellite collars, the Davis Strait subpopulation is delineated in Canada within the Labrador Sea, eastern Hudson Strait, Davis Strait south of Cape Dyer, and along a portion of southwest Greenland (Stirling et al. 1980, Stirling and Kiliaan 1980, Taylor and Lee 1995, Taylor et al. 2001). A genetic study of polar bears (Paetkau et al. 1999) indicated significant differences between bears from southern DS and both Baffin Bay and Foxe Basin; Crompton et al. (2008) found that individuals from northern portions of DS and those from Foxe Basin share a high degree of ancestry. Peacock et al. (2015) used samples from both northern and southern DS in an updated circumpolar genetic analysis and found that the two regions are so distinct as to belong to two different global genetic clusters (southern DS to Southern Canada and northern DS to the Canadian Archipelago).

According to mark-recapture studies conducted between 1974 and 1979, 700-900 bears were estimated to be present in the southern Baffin Island portion of the current delimitation of DS and 60-90 additional bears in the northern Labrador coast portion (Stirling et al. 1980, Stirling and Kiliaan 1980). In 1993 the PBTC established the DS subpopulation abundance estimate at 1,400 polar bears to account for the bias in sampling in the original studies. This estimate was subjectively raised again to 1,650 in 2005 based on the minimum population size that would be needed to sustain the harvest level occurring at that time and the fact that TK suggested that more bears were being seen over the last 20 years. In addition, harp seals, an important prey species for that population, had increased dramatically over the same period (DFO 2010), providing a much-enhanced potential prey base for polar bears.

Because of the uncertainties surrounding the population status, the Government of Nunavut (GN) conducted another population inventory from 2005 - 2007, resulting in an abundance estimate of 2,158 (95% CI: 1833 – 2542) bears (Peacock et al. 2013). At that time, the subpopulation was assessed as stable but was displaying lowered reproductive rates. Polar bear survival in DS varied with time and geography and was related to factors that included reductions in sea ice habitat and increases of harp seal (*Pagophilus groenlandicus*) numbers (Peacock et al. 2013). It was suggested that the observed lowered reproductive rates and the decline in body condition of polar bears in DS could be a result of habitat changes and/or increased polar bear density (Peacock et al. 2013, Rode et al. 2012).

A two-year genetic-mark-recapture (biopsy) study was conducted in 2017 and 2018 involving all of the DS management jurisdictions and Boards. Genetic analyses have been completed and modeling is underway to obtain a population abundance estimate. Demography, recruitment and body condition were also documented as part of the study.

### Traditional Ecological Knowledge

Concurrently with the 2017-2018 scientific study, TK studies in Nunavut, Nunavik, and Nunatsiavut, are at various stages of completion. Nunavut is collecting TK from knowledge holders in Pangnirtung, Iqaluit, and Kimmirut about polar bear health, current and past abundance perception and distribution. The Nunavik Marine Region Wildlife Board released the Davis Strait portion of their comprehensive study of Nunavik Inuit Knowledge and values in 2019 (NMRWB, 2019). The report includes current and historic information on polar bear health, feeding, abundance, distribution, and migration, as well as Inuit use of polar bears as an economic, cultural, and food resource. In 2015, the Torngat Wildlife & Plants Co-Management Board released a report on Labrador polar bear TK based on interviews with knowledge holders in Nunatsiavut. It covered polar bear health and physical condition, distribution and demography, abundance, their physical environment and changes to it, as well as hunting and conservation (York et al. 2015).

### Harvest management

The DS subpopulation is shared between Greenland, Nunavut, Nunatsiavut (Newfoundland and Labrador) and Nunavik (Québec). Nunavut has a quota of 61 bears, Greenland has a quota of 3, Nunatsiavut a quota of 12; there is currently no quota in Nunavik. The 2018 Davis Strait population estimate (to be released 2021) will inform ongoing inter-jurisdictional harvest management.

*Greenland*

This region currently has a quota which was introduced in 2006 with mandatory reporting and monitoring.

*Nunavut*

This region has had a managed harvest with mandatory reporting for 40+ years. Community compliance and reporting is high (>98%) with Conservation Officers in each community to ensure proper monitoring of the polar bear harvest. The Total Allowable Harvest (TAH) was increased in 2012/2013 from 46 to 61 bears annually in order to slightly reduce the DS subpopulation. The average annual removal for the 2012/2013 – 2019/2020 time periods has however remained at 44.5 bears, which is below the current TAH. The Flexible Quota System (FQS) involving a 2:1 male to female harvest sex ratio was introduced in 1995/1996, however, after extensive consultations and public feedback from communities in Nunavut, and the development of the Nunavut Polar Bear Co-Management Plan, changes to the polar bear harvest administration were introduced in 2019/2020. With the new co-management plan, which was approved by the Nunavut Wildlife Management Board, the harvest sex ratio was changed where communities could harvest up to 1 female for every male. Due to the protections that are in place for denning bears and females with offspring (family groups) the potential that this management change could be the cause for a decline of the DS subpopulation is low. Adult female polar bears are the most important contributors to population growth and the harvest sex ratio has remained close to a 2:1 male to female ratio since the switch to the “up to 1:1 harvest ratio”. The affects from the change in harvest sex-ratio on the actual sex ratio of harvested bears will continue to be monitored by the Government of Nunavut.

*Nunatsiavut*

In Newfoundland and Labrador, polar bear are listed as vulnerable under the Provincial Endangered Species Act (ESA), and general direction on management objectives is provided under the auspices of the ESA. The Government of NL&L, in consultation with Nunatsiavut Government (NG) and its respective Boards, are in the process of preparing a polar bear management plan that will set

out these general management objectives. A framework for subsequent harvest management implementation will also be updated in accordance with the Labrador Inuit Land Claim Agreement (LILCA). Currently, the annual total allowable harvest (TAH) for Nunatsiavut is 12 bears. For all bears harvested by Nunatsiavut beneficiaries, there is mandatory reporting with full compliance. Issues relating to inter-jurisdictional harvest inequity and reporting requirements remain as key focal areas.

*Québec*

Currently, there is no quota or mandatory reporting in this province. Total annual harvest levels are unknown but reported harvest levels between 2012/2013 – 2019/2020 have ranged from 12 bears per year to 59, with an average annual removal of 27 bears. The incomplete monitoring of the harvest done by Québec could have negative effects on the overall subpopulation since the actual total harvest in the subpopulation is unknown. The Québec government, in collaboration with the Nunavik and Eeyou Marine Regions Wildlife Boards, is in the process of adopting its polar bear management plan. This plan will provide a framework for subsequent harvest monitoring, reporting and the management of polar bear subpopulations occurring within Québec, including DS.

**Protected areas**

The Torngat Mountains National Park occurs in northern Labrador, which protects polar bear on-shore and denning habitat from development.

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## Foxe Basin (FB)

### Status and delineation

Based on decades of mark-recapture studies and satellite tracking of female bears in Western Hudson Bay (WH) and Southern Hudson Bay (SH), the Foxe Basin subpopulation appears to occur in Foxe Basin, northern Hudson Bay, and the western end of Hudson Strait (Taylor and Lee 1995; Sahanatien *et al*. 2015). The most recent mapping of satellite telemetry data, 2008-2009, indicates substantial overlap with the WH subpopulation and, to a lesser extent, with SH and DS (Peacock *et al*. 2010; Sahanatien *et al*. 2015) when the bears are out on the sea ice. During the ice-free season, polar bears are concentrated on Southampton Island and along the Wager Bay coast; however, significant numbers of bears are also encountered on the islands and coastal regions throughout the Foxe Basin area (Stapleton *et al*. 2015).

A 1994 subpopulation abundance estimate of 2,197 (95% CI: 1,989-2,405) was calculated (Taylor *et al*. 2006) from a mark-recapture analysis based on tetracycline biomarkers where the marking effort was conducted during the ice-free season, and distributed throughout the entire area. TEK gathered from consultations conducted in Foxe Basin communities between 2004 and 2012 suggested that the subpopulation of polar bears had increased since that initial survey. During a comprehensive summertime aerial survey in 2009 and 2010 (based on distance sampling and double-observer estimation) covering about 40,000 km each year, 816 and 1,003 bears were observed, respectively (Stapleton *et al*. 2015). This most recent study yielded an abundance estimate of 2,585 (95% CI: 2,096 – 3,189) polar bears (Stapleton *et al*. 2015), which is not statistically different from the 1994 estimate and indicated a stable population.

### Habitat

Fragmentation of sea ice has increased, and total concentration and ice-floe size has decreased in FB over the last 25 years (Sahanatien and Derocher 2012), which has resulted in a reduction in sea ice habitat for polar bears (Stern and Laidre 2016). Stirling and Parkinson (2006) predicted eventual population decline based on past and predicted changes in ice habitat for polar bears but no direct evidence could be provided during the 2009-2010 aerial survey that would suggest bears of FB are currently affected negatively by climatic change (Stapleton *et al*. 2015).

### Harvest management

Foxe Basin is shared between Nunavut and Québec.

*Nunavut*

In response to the subpopulation estimate from 1994, harvest levels in Nunavut were reduced in 1996 from 137 to 96 bears/year to permit a slow recovery of this subpopulation. After consultations in 2005, the Nunavut quota was increased to a level consistent with the increasing trend observed by Inuit and a subpopulation level estimated at 2,300 bears (106/year). The Nunavut Total Allowable Harvest (TAH) was increased from 106 to 123 bears/year in 2014/2015 based on the 2009-10 aerial survey results suggesting that the subpopulation could withstand a higher removal rate.

In September 2019, a new Nunavut Polar Bear Co-management Plan was approved by the Nunavut Wildlife Management Board, following five years of consultation and development with co-management partners in Nunavut. The Plan replaced the Memoranda of Understanding that had previously been in place. Concomitant with the approval of the new Plan, and in response to public and stakeholder feedback, Nunavut changed the sex-ratio of the harvest. Beginning with the 2019/2020 harvest season, up to 50% of a community's quota can be harvested as females, which replaces the previous 2:1 male-biased harvest; no changes to existing community TAHs were made. Therefore, there is a potential that the biological risk of negative population outcomes due to harvest will increase because more adult female polar bears could be taken and these bears are the most important contributors to population growth. The GN is monitoring how this implemented change in harvest sex-ratio will affect the sex-ratio of harvested bears.

*Québec*

As of 2020/2021 harvest season, there are no quotas or mandatory reporting in Quebec for FB. Voluntary reported harvest in northern Quebec averaged 4 bears/year between 2008/2009 and 2019/2020.

### Protected areas

Ukkusiksalik is a National Park in Nunavut that protects an area of bear summer concentration from development; currently there are few tourists to this National Park.

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## Gulf of Boothia (GB)

### Status and delineation

The boundaries of the Gulf of Boothia subpopulation are based on genetic studies (Paetkau *et al*. 1999; Campagna *et al*. 2013; Peacock *et al*. 2015; Malenfant *et al*. 2016), movements of tagged bears (Stirling *et al*. 1978; Taylor and Lee 1995), radiotelemetry in GB and adjacent areas (Taylor *et al*. 2001), and interpretations by local Inuit hunters of how local conditions influence the movements of polar bears in the area. Gulf of Boothia belongs in the Canadian Archipelago global genetic cluster (Peacock *et al*. 2015). An initial subpopulation estimate of 333 bears was derived from the data collected within the boundaries proposed for GB, as part of a study conducted over a larger area of the central Arctic (Furnell and Schweinsburg 1984). Although population data from this area were limited, local hunters reported that numbers remained constant or increased since the time of the central Arctic polar bear survey in the late 1970s and early 1980s. Based on TEK, recognition of sampling deficiencies, and polar bear densities in other areas, an interim subpopulation estimate of 900 was established in the 1990s. Following the completion of a mark-recapture inventory in spring 2000, the subpopulation abundance was estimated to be 1,592 ± 361 bears (Taylor *et al*. 2009). Natural survival and recruitment rates were estimated at values higher than the previous standardized estimates (Taylor *et al*. 1987). Taylor *et al*. (2009) concluded that the subpopulation was increasing in 2000, as a result of high intrinsic rate of growth and low harvest. Harvest rates were increased in 2005 based on the 2000 population estimate and the population was believed to be stable.

A three-year, genetic mark-recapture population inventory study was conducted between 2015 and 2017. Results of live-capture dead-recovery models suggest a mean abundance estimate of 1,525 ± 294 bears for the period 2015-2017, which was similar to the previous mean abundance estimate 1998-2000 (Dyck *et al.* 2020). Mean cub-of-the-year and yearling litter sizes for the period 2015 – 2017 were 1.61 (95% confidence interval [CI] = 1.51 – 1.70) and 1.53 (95% CI = 1.41 – 1.64), respectively, with no apparent trend compared to 1998 – 2000. The mean number of yearlings per adult female for the period 2015 – 2017 was 0.36 (95% CI = 0.26 – 0.47) which suggests that GB is currently a productive polar bear subpopulation, despite sea ice change. This is consistent with the finding that polar bear body condition (i.e., fatness) in the spring improved between the periods 1998 – 2000 and 2015 – 2017. The results for subpopulation size and trend should be interpreted with caution because the genetic mark-recapture study 2015 – 2017 did not include movement data. Thus, the estimate of abundance reflects the "superpopulation" (e.g., it includes all bears that use the GB management area, some of which spend time in other subpopulations).

### Harvest management

The GB subpopulation is managed solely by Nunavut. The GB quota was increased in 2005 from 40 bears to 74 bears, based on TEK of increasing numbers of bears (Keith *et al.* 2005) and the results of the 1998 -- 2000 study (Taylor *et al.* 2009). Harvest of bears in GB has generally been below the recommended quota, with an annual mean harvest of 63 bears since 2005.

In September 2019, the new Nunavut Polar Bear Co-management Plan was approved by the Nunavut Wildlife Management Board, following five years of consultation and development with co-management partners in Nunavut. The Plan replaced the Memoranda of Understanding that had been in place. Concomitant with the approval of the new Plan, and in response to public and stakeholder feedback, Nunavut changed the allowable harvest sex-ratio. Beginning with the 2019/2020 harvest season, up to 50% of a community's quota can be harvested as females without entering an overharvest situation. This replaces the 2:1 male-to-female harvest sex-ratio and no changes to existing community TAHs were made. There is a potential that the biological risk of negative population outcomes due to harvest will increase because adult female polar bears are the most important contributors to population growth. The GN is monitoring how this implemented change in harvest sex-ratio will affect the sex-ratio of harvested bears.

### Traditional Ecological Knowledge

Keith *et al.* (2005) report that the number of bears in GB increased since the mid 1980's.

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## Kane Basin (KB)

### Status and delineation

Based on the movements of adult females with satellite collars and recaptures of tagged animals, the boundaries of the Kane Basin subpopulation include the North Water Polynya to the south, the Kennedy Channel to the north and Greenland and Ellesmere Island to the east and west (Taylor *et al*. 2001). Polar bears in KB do not differ genetically from those in Baffin Bay (Paetkau *et al*. 1999; Peacock *et al*. 2015). The size of the subpopulation was estimated to be 164 ± 35 (SE) for 1994 – 1997 by Taylor *et al*. (2008). The intrinsic natural rate of growth for KB polar bears was estimated to be low at 1.009 (SE, 0.010) (Taylor *et al*. 2008), likely because of large expanses of multi-year ice and low population density of seals (Born *et al*. 2004). A genetic mark-recapture survey (via biopsy darting) and aerial survey were completed in 2014 resulting in a new population estimate, survival rates, and habitat use analyses (SWG 2016). Using genetic mark-recapture, the estimated abundance of the KB subpopulation was 357 polar bears (95% CI: 221 – 493) for 2013 – 2014. More bears were documented in the eastern regions of the KB subpopulation during 2012 – 2014 than during 1994-1997.The difference in distribution between the 1990s and 2010s may reflect differences in spatial distribution of bears, possibly influenced by reduced hunting pressure by Greenland in eastern KB but also some differences in sampling protocols. An estimate of abundance based on a springtime 2014 aerial survey in KB was 206 bears (95% lognormal CI: 83 - 510). However, due to insufficient coverage of offshore polar bear habitat, this estimate is likely negatively biased. The total number of bears marked during studies in 2012-2013 in KB was equivalent to ~25% of the estimated population size. Despite this, documented cases of emigration comprised < 4% of recaptures and recoveries in KB.

Changing sea-ice conditions have resulted in broad movement and habitat use patterns of KB bears that are more similar to those of bears in seasonal sea-ice ecoregions. The size of the subpopulation range has expanded since the 1990s in all seasons, especially in summer (June-September) where ranges doubled between the 1990s and the 2000s. Land use in KB during summer remains intermittent because some sea ice remains inside fjords and coastal areas. Reproductive metrics for KB were comparable between the 1990s and 2010s sampling periods. Body condition in KB appeared to have slightly improved between sampling periods (see SWG 2016; Laidre *et al*. 2020). Overall, the data on abundance when considered with data on movements, condition, and reproduction, suggest that the subpopulation has increased.

### Harvest management

In 2009, the Canada-Greenland Joint Commission (JC) was established to manage polar bears within Kane Basin and Baffin Bay collaboratively, and to ensure their conservation. After the new population assessment concluded, a harvest risk assessment of the KB polar bear subpopulation was completed for the JC by the SWG to provide various harvest scenarios that could guide management decisions (Regehr *et al*. 2017). The harvest risk analyses incorporated various demographic approaches and vital rates based on polar bear life history, and potential effects of future sea-ice conditions on polar bear population size and status through projected trends in carrying capacity. The SWG harvest risk analysis recommended a possible removal of up to 10 (2.8%) bears from the KB polar bear subpopulation, which resulted from the high uncertainty in vital rates and overall small sample sizes during the population study. The current quota for KB is 10 bears for Greenland, and 5 for Nunavut per year. So far, the combined catches from Nunavut and Greenland for the KB subpopulation have remained well below 10 polar bears per year.

In September 2019, the new Nunavut Polar Bear Co-management Plan was approved by the Nunavut Wildlife Management Board. With the approval of the new plan, a change in the existing Nunavut polar bear harvest management system occurred: beginning with the 2019/2020 harvest season up to 50% of the communities' quota can be harvested as females without entering into an overharvest situation. The 2:1 male-to-female harvest sex ratio was changed to a 'up to 1:1 male-to-female' harvest by increasing the number of females that can be harvested (i.e., maintaining overall harvest level). There is a potential that the biological risk of negative population outcomes due to harvest will increase because adult female polar bears are the most important contributors to population growth. How this administrative change in harvest sex-ratio is affecting the sex ratio of harvested bears is being monitored by the Government of Nunavut.

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## Lancaster Sound (LS)

### Status and delineation

Information on the movements of adult female polar bears monitored by satellite radio-collars, and mark-recapture data has shown that this subpopulation is distinct from the adjoining Viscount Melville Sound, M'Clintock Channel, Gulf of Boothia, Baffin Bay and Norwegian Bay subpopulations (Taylor *et al*. 2001). This distinction is supported by genetic data (Paetkau *et al*. 1999; Malenfant *et al*. 2016; Peacock *et al*. 2015); polar bears in LS belong to the *Canadian Archipelago* genetic cluster (Malenfant *et al*. 2016; Peacock *et al*. 2015). Survival rates of the pooled Norwegian Bay and LS populations were used in a population viability analysis (PVA) to minimize sampling errors; the available subpopulation estimate of 2,541 ± 391 is based on an analysis of both historical and current mark-recapture data to 1997 (Taylor *et al*. 2008). Taylor *et al*. (2008) estimated survival and recruitment parameters that suggest this subpopulation has a lower renewal rate than previously estimated. However, what effect this may, or may not, have on the present population demographics is not known, especially under changing sea-ice conditions. Currently, the population data are outdated but the population is thought to be stable based on local traditional knowledge (Canadian Wildlife Service 2009). A new population study is planned to begin in 2021.

### Harvest management

Lancaster Sound is managed solely by Nunavut. The polar bear harvest in LS has been more male-selective for decades as compared to any other Nunavut subpopulations, in part because of guided sport hunts. Sport hunting has been an important economic activity for hamlets in Nunavut, but more so for communities that harvest from LS – approximately 40% of all Nunavut sport hunts occur in LS (Government of Nunavut, unpublished data). With the 2008 ban on hide importation into the US, sport-hunting tourism declined from around 45%, and remained near 20% of the LS harvest during 2016/2017. The mean male proportion of the harvest since 1983 has been about 0.72, which is higher than the prescribed 2:1 harvest sex ratio (Government of Nunavut, unpublished data). McLoughlin *et al.* (2005) examined the conservation risk of male-selective harvesting of polar bears but there are no sufficient data to examine the long-term effects of that harvest regimen on LS polar bear demography. However, data collected during the proposed 2021-2023 study may aid such endeavors. The quota increased in 2004/2005 from 78 to 85 bears annually; the mean removal per year since 2004/2005 has been 82.8 bears (range: 70 – 94 bears).

In September 2019, the new Nunavut Polar Bear Co-management Plan was approved by the Nunavut Wildlife Management Board, following five years of consultation and development with co-management partners in Nunavut. The Plan replaced the Memoranda of Understanding that had been in place. Concomitant with the approval of the new Plan, and in response to public and stakeholder feedback, Nunavut changed the allowable harvest sex-ratio. Beginning with the 2019/2020 harvest season, up to 50% of a community's quota can be harvested as females without entering an overharvest situation. This replaces the 2:1 male-to-female harvest sex-ratio and no changes to existing community TAHs were made. There is a potential that the biological risk of negative population outcomes due to harvest will increase because adult female polar bears are the most important contributors to population growth. The GN is monitoring how this implemented change in harvest sex-ratio will affect the sex-ratio of harvested bears.

### Protected areas

Qausuittuq National Park and portions of Sirmilik National Park provide protection of denning and summering polar bear habitat. One of Canada's largest National Marine Conservation Areas was created in Lancaster Sound in 2019: *Tallrutiup Imanga* covers large areas of central and eastern LS.

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## M'Clintock Channel (MC)

### Status and delineation

The current population boundaries for the M'Clintock Channel (MC) subpopulation are based on recovery of tagged bears, movements of adult females with satellite radio-collars in adjacent areas (Taylor and Lee 1995, Taylor *et al.* 2001), and genetics (Paetkau *et al*. 1999; Campagna *et al*. 2013; Peacock *et al*. 2015, Malenfant *et al*. 2016). An initial physical mark-recapture study was carried out from 1973 – 1978 (Furnell and Schweinsburg 1984) in areas that included portions of what is now known as MC and the adjacent Gulf of Boothia subpopulation together. The total abundance estimate for that areas was 1081 bears, but the estimate was known to be biased by non-representative sampling. It was subsequently increased to 900 for GB and 900 for MC based on local indigenous knowledge and back-calculations to determine abundance levels necessary to sustain the existing subsistence harvest levels (Aars *et al*. 2006; Taylor *et al*. 2006). In the mid-1990s, the MC estimate was revised downwards to 700 based on hunter reports of reduced densities of polar bears (Aars *et al.* 2006; Taylor *et al*. 2006). Following the completion of a mark-recapture inventory in spring 1998-2000, which covered the currently delineated subpopulation area, the abundance was estimated at 284 ± 59.3 bears (Taylor *et al.* 2006). Natural survival and recruitment rates were estimated at values lower than previous standardized estimates (Taylor *et al.* 1987).

A new 3-year genetic mark-recapture study was conducted between 2014 and 2016, indicating that the population increased to 716 bears (95% Credible Interval: 545-955; Dyck *et al.* 2020). Body condition of bears between 1998-2000 and 2014-2016 improved indicating that temporal and spatial changes in sea ice conditions likely improved marine productivity and benefitted bears. The results for subpopulation size and trend should be interpreted with caution because the 2014 – 2016 genetic mark-recapture study did not include movement data (radio-collars) and thus, the estimate of abundance reflects the "superpopulation" (e.g., it includes all bears that use the MC management area, some of which spend time in other subpopulations).

### Habitat

Similar to habitat in GB, Barber and Iacozza (2004) found no trends in ringed seal habitat or sea ice conditions from 1980 to 2000 for the MC area. A general trend has been detected for earlier break-up and delayed freeze-up (Stern and Laidre 2016; Markus *et al*. 2009), with multi-year ice shifting to lesser occurrence than annual ice as compared to previous decades (e.g. Howell *et al*. 2015). Habitat quality could be improved over the short-term as multi-year ice declines.

There is the potential for increased shipping activities in parts of the MC area as the Northwest Passage becomes more navigable in the future.

### Harvest management

The MC subpopulation is managed solely by Nunavut. Past harvests in MC of 34 bears per year between 1979 – 1999 were considered unsustainable (Aars *et al.* 2006; Taylor *et al.* 2006) based on local knowledge of decreased bear density and the results of the 1998 – 2000 capture mark-recapture study. Consequently, a harvest moratorium was put in place for the 2001/2002 and 2002/2003 harvest seasons followed by a quota of 3 bears annually until 2015. Local hunters observed more bears during the late 2000's, which resulted in an increase of the annual quota from 3 to 12 bears in 2015/2016 at a 2:1 male-biased harvest.

In September 2019, the new Nunavut Polar Bear Co-management Plan was approved by the Nunavut Wildlife Management Board, following five years of consultation and development with co-management partners in Nunavut. The Plan replaced the Memoranda of Understanding that had been in place. Concomitant with the approval of the new Plan, and in response to public and stakeholder feedback, Nunavut changed the allowable harvest sex-ratio. Beginning with the 2019/2020 harvest season, up to 50% of a community's quota can be harvested as females without entering an overharvest situation. This replaces the 2:1 male-to-female harvest sex-ratio and no changes to existing community TAHs were made. There is a potential that the biological risk of negative population outcomes due to harvest will increase because adult female polar bears are the most important contributors to population growth. The GN is monitoring how this implemented change in harvest sex-ratio will affect the sex-ratio of harvested bears.

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## Northern Beaufort Sea (NB)

### Boundary

The Northern Beaufort Sea (NB) subpopulation extends from Tuktoyaktuk (133° W) east through Amundsen Gulf and Dolphin and Union Strait to include Coronation Gulf. It covers nearly all of the Northern Beaufort Sea and into M'Clure Strait. This boundary was formally accepted by management authorities for the Northern and Southern Beaufort Sea polar bear subpopulations in 2013. The NB subpopulation includes portions of the Northwest Territories and Nunavut. The previous boundary between the Southern Beaufort (SB) and NB polar bear subpopulation existed at approximately 125°W longitude, near Pearce Point, NWT (Brower *et al.* 2002). . The boundary change was proposed by researchers, resulting from radio telemetry studies that suggest this boundary did not reflect the space use patterns of bears in the eastern portion of the southern Beaufort (SB) Sea - records indicate that approximately 90% of the bears harvested near Baillie Islands were actually NB bears (Amstrup *et al*. 2005). In consideration of the apparent misallocation of NB bears to the SB harvest, the Wildlife Management Advisory Council (NWT) (WMAC NWT) and Inuvialuit Game Council (IGC) consulted with communities regarding the potential to change the SB/NB boundary. As a result, in 2013/14, the boundary was moved west to 133°W longitude, near the community of Tuktoyaktuk, NWT. The proportional representation of NB versus SB bears reduces to approximately 50:50 at this longitude, thus allowing harvest to be more accurately allocated between the subpopulations. A re- analysis of 2001-2006 capture data (Regehr et al 2007, Stirling et al 2007) was undertaken to estimate the SB and NB subpopulations under the new boundary (Griswold *et al.* 2017). The mean number of bears moved from the SB to NB is 311, which is being used until another subpopulation estimate is available (Griswold *et al.* 2017).

### Overview of co-management partners and management objectives

The management partners and collaborating agencies for the NB subpopulation on the Inuvialuit Settlement Region (ISR) side are the Government of the Northwest Territories, the WMAC (NWT), the IGC, and Environment and Climate Change Canada. In Nunavut, management partners include Government of Nunavut, Kugluktuk Hunters and Trappers Organization, Kitikmeot Regional Wildlife Board and the Nunavut Wildlife Management Board. Management objectives and guiding principles for the NB are outlined in *the Polar Bear Management Agreement for the North[ern] Beaufort Sea and Viscount Melville Sound Polar Bear Populations between Inuit of the Kitikmeot West Region in Nunavut and the Inuvialuit* (2006). The primary objectives of this agreement are:

- To maintain the Northern Beaufort Sea and Viscount Melville Sound polar bear populations at healthy viable levels in perpetuity, and

- To manage polar bears on a sustained yield basis in accordance with all the best information available

Under the *Species at Risk (NWT) Act,* polar bears are listed as a species of Special Concern. The *Inuvialuit Settlement Region Polar Bear Joint Management Plan* was published in 2017 for the species; the goal of this plan is to ensure the long-term persistence of healthy polar bears in the ISR while maintaining traditional Inuvialuit use.

### Indigenous Knowledge

To date, a number of Indigenous knowledge (IK) studies have been completed that cover the ISR polar bear populations; the largest in scope and most recent is the 2015 book *Inuvialuit and Nanuq: A polar bear traditional knowledge study* (Joint Secretariat, 2015). It is important to note, however, there can be significant IK presented orally during events like project consultation meetings or public hearings that is often not adequately captured in a way to use as reference material. *Inuvialuit and Nanuq* (Joint Secretariat, 2015) describes Indigenous knowledge:

> "The most important aspects of Indigenous knowledge concerning polar bears are the intergenerational knowledge (acquired from parents, grandparents and other elders) combined with direct experience. In general, this is what Inuvialuit mean by Traditional Knowledge (TK): personal knowledge acquired by travelling across ice, hunting seals and polar bears, running dog teams, reading wind directions, snow and cloud patterns, geographic features, currents and stars, and by intergenerational transmission." – JS 2015, p. 9

Inuvialuit note that "ice conditions, the effects of climate change and polar bear behaviour are extremely complex." (JS 2015, p. 197) Inuvialuit are reluctant to speculate about the future and long-term polar bear survival trends, given the high level of uncertainty in ecological conditions and how both bears and Inuvialuit will respond to these changes (JS 2015). Inuvialuit knowledge provides relative observations that can, in some cases, be used comparatively, to assess trends over time, or to draw a fuller picture of the NB polar bear subpopulation.

*Abundance*

During the verification workshop for *Inuvialuit and Nanuq* (JS 2015), consensus statements on changes to polar bear abundance over the lifetime of the TK holders were generated for each community:

- Sachs Harbour — "I don't see the numbers going down. We're seeing more around town, but that doesn't mean there's a decline in the numbers" (JS 2015, p. 184)

- Ulukhaktok — "maybe a little change, but overall about the same. Polar bear movements are always different every year. To me it's the same, but a little bit change since when I was younger" (JS 2015, p. 184)

- Paulatuk — "The big picture is that they're stable" – (JS 2015, p. 184)

The 2012 *Species Status Report for Polar Bear (Ursus maritimus) in the Northwest Territories* (SARC, 2012) provides a summary of other sources of Inuvialuit and local knowledge of relative polar bear and seal abundance in the Inuvialuit Settlement Region (see that SARC 2012 for further detail). This historic perspective demonstrates the complexities of polar bear ecology and that the abundance and distribution of polar bears and their prey has always been variable.

*Body Condition*

Inuvialuit knowledge holders in *Inuvialuit and Nanuq* (2015) agreed that polar bear body condition has remained generally stable over time, despite considerable variability within and between years. Inuvialuit also indicated that, since the 1980s, there have been less really big bears observed, and the big bears aren't as fat (JS 2015).

*Distribution*

In some parts of the ISR, Inuvialuit knowledge holders have observed dens in different places than they were before and females with cubs have been observed entering and leaving dens at different times – this is attributed to changing weather patterns (JS 2015). Sachs Harbour knowledge holders have observed far less landfast ice than there was before the mid-1980s, which results in polar bears staying closer to the community (JS 2015). Polar bears are being observed closer to the mainland in and around Tuktoyaktuk and Paulatuk. Inuvialuit have not linked these changes in distribution to changes in polar bear abundance (JS 2015).

*Climate Change*

Inuvialuit see and experience climate change firsthand, noting changes to temperature, freeze-up, break-up, ice conditions, wind and storm patterns; the book *Inuvialuit and Nanuq* (2015) explores Inuvialuit observations of climate change since the 1980s. Despite observations of the climate change and a nuanced understanding of polar bear ecology, Inuvialuit have not yet seen changes to polar bear abundance or condition (JS 2015). Inuvialuit consensus is that:

> **"**For the Inuvialuit, the future cannot be predicted; it could be good or bad as far as polar bears are concerned. However, the consensus among the workshop participants was that polar bears are highly intelligent animals that can adapt to climate change because they have been adapting to many things for thousands of years." (JS 2015, p. 196)

**Scientific Knowledge**

*Abundance*

Scientific study of the NB polar bear subpopulation extends back to the 1970s. It is worth noting that scientific polar bear research is very expensive and takes place in remote, dangerous areas where weather patterns are highly unpredictable. These factors can significantly affect study success and the frequency of population inventories.

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

Table 5. Population estimates for Northern Beaufort Sea subpopulation

| Inventory period | Population Estimate | 95% Confidence Interval | Estimate for Management Purposes | Comments and Reference |
|---|---|---|---|---|
| 1972-1975 | 745 | ± 246 | 1,200 | Stirling *et al.* 1975, Estimate from Stirling et al 2007 |
| 1985-1987 | 847 | ± 141 | 1,200 | Stirling *et al.* 1988, Estimate from Stirling et al 2007 |
| 1992-1994 | 289 | ± 62 | 1,200 | Only area north of Norway Island covered consistently. (Lunn *et al.* 1995.) Estimate from Stirling et al 2007 |
| 2004-2006 | 908 | ± 155 | 1,400 | Estimate from Stirling et al 2007 and Stirling et al 2011. Increase in estimate based on negative bias due to lack of capture effort in north and east portions of study area. Stirling *et al.* 2011 state estimate 1200-1300in 2004 -2005 more reasonable. |
| 2006 | 1,291 | | 1,711 | Boundary change moves estimated 311 bears based on analysis in 2009 (Griswold et al. 2017) and estimate used for management purposes adjusted for bias in sampling. |

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

The NB population estimate under the current boundary is 1,291, a number derived from the 2000s estimate with the addition of 311 bears (following analysis in 2009) that estimated the number of bears that would shift between subpopulations under the boundary change (Griswold et al. 2017).

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

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

A genetic mark-recapture survey of the Southern and Northern Beaufort Sea subpopulations is underway. The first year of field work was 2019, with three to four years of fieldwork planned in total. Field work in 2020 was postponed due to the Covid-19 pandemic.

*Climate Change*

Multiple indicators of climate change impacts on sea ice have been noted for the NB polar bear subpopulation. From 1979 to 2014, researchers have observed: a declining number of ice-covered days, a declining rate of June to October sea ice concentration, and an increasing number of ice-covered days (Stern and Laidre 2016). The length of the summer season increased by 9.0 days from 1979 to 2014 for the NB (Stern and Laidre 2016).

**Harvest**

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

Within Canada, quotas were first established in NWT by the 33rd Session of the Territorial Council at Resolute Bay. The quotas were to become effective on July 1 for the 1967-68 hunting season. In the absence of data, quotas for each settlement were established by averaging the harvest of the previous 3 years and then reducing that number by a modest amount (Brower et al 2002).

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

Currently a combined (NU and NWT) total allowable harvest for NB is 77 bears per year, but the actual average harvest over the last five years is approximately 40 (GNWT unpublished data). In NU (quota of 6/year), harvest has declined, in part because of increasing difficulty of Kugluktuk residents to reach areas where there are bears, because of changing ice conditions. Harvest of the NB subpopulation has been below the quota for several years. Changing sea ice conditions, and the length, distance needed to travel, difficult and cost of travel to access bears are all cited as reasons (Larry Carpenter pers. comm. 2020). Changing sea ice conditions has made it difficult for Inuvialuit to rely on established IK for planning harvest activities (JS, 2015).

**Protected areas**

Some denning habitat is protected in Aulavik National Park on the northern coast of Banks Island, Northwest Territories but most known maternity denning in NB occurs along the southern and western coastlines of Banks Island, and associated small offshore islands. Bears in dens are protected by Hunters and Trappers Committee by-laws and regulations.

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## Norwegian Bay (NW)

**Status and delineation**

The Norwegian Bay subpopulation is bounded by heavy multi-year ice to the west, islands to the north, east, and west, and polynyas to the south (Stirling *et al.* 1993; Stirling 1997; Taylor *et al.* 2008). Data collected during mark-recapture studies, and from satellite radio-tracking of adult female polar bears, suggest that most of the polar bears in this subpopulation are concentrated along the coastal tide cracks and ridges along the north, east, and southern boundaries (Taylor *et al.* 2001). The most current (1993 – 97) estimate is 203 ± 44 (SE; Taylor *et al.* 2008). Survival rate estimates for the NW subpopulation were derived from pooled Lancaster Sound and NW data because the subpopulations are adjacent and the number of bears captured in NW was too small to generate reliable survival estimates. The NW subpopulation appears to be genetically unique (Malenfant *et al*. 2016). The available population data are dated; a new study is planned to begin in 2021.

**Sea ice habitat**

There is no up-to-date sea-ice information. Throughout the 1990s, the preponderance of heavy multi-year ice through most of the central and western areas resulted in low densities of ringed seals (Kingsley *et al.* 1985) and, consequently, low densities of polar bears. However, if multi-year ice becomes more dynamic, habitat quality and productivity may improve over the short-term (Derocher *et al*. 2004; Markus *et al*. 2009; Sou and Flato 2009; Maslanik *et al*. 2011; Howell *et al*. 2008; Laidre *et al*. 2020).

**Harvest management**

The NW subpopulation is managed solely by Nunavut. The harvest quota for the NW subpopulation was set to 4 bears (3 males and 1 female) in 1996. The 5-year mean harvest (2015/16 – 2019/2020) of 1.2 bears/year is below a sustainable harvest level for that population size. Currently, the only Nunavut community that harvests from NW is Grise Fiord.

In September 2019, the new Nunavut Polar Bear Co-management Plan was approved by the Nunavut Wildlife Management Board, following five years of consultation and development with co-management partners in Nunavut. The Plan replaced the Memoranda of Understanding that had been in place. Concomitant with the approval of the new Plan, and in response to public and stakeholder feedback, Nunavut changed the allowable harvest sex-ratio. Beginning with the 2019/2020 harvest season, up to 50% of a community's quota can be harvested as females without entering an overharvest situation. This replaces the 2:1 male-to-female harvest sex-ratio and no changes to existing community TAHs were made. There is a potential that the biological risk of negative population outcomes due to harvest will increase because adult female polar bears are the most important contributors to population growth. The GN is monitoring how this implemented change in harvest sex-ratio will affect the sex-ratio of harvested bears.

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## Southern Beaufort Sea (SB)

### Boundary

The boundary for the Southern Beaufort (SB) subpopulation extends from 133°W at approximately Tuktoyaktuk, west to Icy Cape, Alaska. This boundary was formally accepted by management authorities for the Northern and Southern Beaufort Sea polar bear subpopulations in 2013. The previous boundary between the SB and Northern Beaufort Sea (NB) polar bear subpopulation existed at approximately 125°W longitude, near Pearce Point, NWT (Brower *et al.* 2002). The boundary change was proposed by researchers, resulting from radio telemetry studies that suggested this boundary did not reflect the space use patterns of bears in the eastern portion of the southern Beaufort Sea. Records indicated that approximately 90% of the bears harvested near Baillie Islands were actually NB bears (Amstrup *et al*. 2005). In consideration of the apparent misallocation of NB bears to the SB harvest, the WMAC (NWT) and IGC consulted with communities regarding the potential to change the SB/NB boundary. As a result, in 2013/14, the boundary was moved west to 133°W longitude, near the community of Tuktoyaktuk, NWT. The proportional representation of NB versus SB bears reduces to approximately 50:50 at this longitude, thus allowing harvest to be more accurately allocated between the subpopulations. A re- analysis of Regehr *et al.* 2001-2006 capture data was undertaken to estimate the SB and (NB) subpopulations under the new boundary (Griswold *et al.* 2017). The mean number of bears moved from the SB to NB is 311, which is being used until another subpopulation estimate is available (Griswold *et al.* 2017).

### Overview of co-management partners and management objectives

Management of the SB subpopulation is jurisdictionally complex. In Canada, there is a co-management structure which involves the governments of Canada, the Northwest Territories, and Yukon as well as the Inuvialuit Game Council, the Wildlife Management Advisory Councils (NWT and North Slope) and the Inuvialuit Hunters and Trappers Committees. The SB subpopulation is shared with Alaska and cooperatively managed under the *Inuvialuit-Inupiat Polar Bear Management Agreement in the Southern Beaufort Sea*, originally signed in 1988. The harvest quota is recommended under the principles of this agreement by the designated Commissioners of the North Slope Borough and the Inuvialuit Game Council, and technical advisors. The primary management objectives in the *Inuvialuit-Inupiat Polar Bear Management Agreement in the Southern Beaufort Sea* are:

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

Under the *Species At Risk (NWT) Act,* polar bears are listed as a species of Special Concern. The *Inuvialuit Settlement Region Polar Bear Joint Management Plan* was published in 2017 for the species; the goal of this plan is to ensure the long-term persistence of healthy polar bears in the ISR while maintaining traditional Inuvialuit use.

### Indigenous Knowledge

To date, a number of Indigenous knowledge (IK) studies have been completed that cover the ISR polar bear populations; the largest in scope and most recent is the 2015 book *Inuvialuit and Nanuq: A polar bear traditional knowledge study.* It is important to note, however, there can be significant IK presented orally during events like project consultation meetings or public hearings that is often not adequately captured in a way to use as reference material. *Inuvialuit and Nanuq* describes Inuvialuit knowledge:

> "The most important aspects of Indigenous knowledge concerning polar bears are the intergenerational knowledge (acquired from parents, grandparents and other elders) combined with direct experience. In general, this is what Inuvialuit mean by Traditional Knowledge (TK): personal knowledge acquired by travelling across ice, hunting seals and polar bears, running dog teams, reading wind directions, snow and cloud patterns, geographic features, currents and stars, and by intergenerational transmission." – JS 2015, p. 9

Inuvialuit note that "ice conditions, the effects of climate change and polar bear behaviour are extremely complex." (JS 2015, p. 197) Inuvialuit are reluctant to speculate about the future and long-term polar bear survival trends, given the high level of uncertainty in ecological conditions and how both bears and Inuvialuit will respond to these changes (JS 2015). Inuvialuit knowledge provides relative observations that can, in some cases, be used comparatively, to assess trends over time, or to draw a fuller picture of the SB polar bear subpopulation.

*Abundance*

During the verification workshop for *Inuvialuit and Nanuq* (JS 2015), consensus statements on changes to polar bear abundance over the lifetime of the TK holders were generated for each community:

- Tuktoyaktuk: "I would say they are the same. Overall throughout the years, they seem pretty stable. The bears are there, just a little bit later. It's just the ice conditions that are changing" (JS 2015, p. 184)
- Aklavik: "I think I'm just too far away to see. But the talk around Aklavik is they are about the

  same numbers. I would agree with everyone" (JS 2015, p. 184)

Sources of Inuvialuit knowledge indicate that the polar bear population cycles over time, that bears tend to follow seals, and that an observed regional decline does not necessarily indicate a population decline. Inuvialuit knowledge holders have noted that seals are highly mobile and experience population cycles (JS 2015).

The 2012 *Species Status Report for Polar Bear (Ursus maritimus) in the Northwest Territories* (SARC, 2012) provides a summary of other sources of Inuvialuit and local knowledge of relative polar bear and seal abundance in the Inuvialuit Settlement Region (see

that SARC 2012 for further detail). This historic perspective demonstrates the complexities of polar bear ecology and that the abundance and distribution of polar bears and their prey has always been variable.

*Body condition*

Inuvialuit knowledge holders in *Inuvialuit and Nanuq* (2015) agreed that polar bear body condition has remained generally stable over time, despite considerable variability within and between years. Inuvialuit also indicated that, since the 1980s, there have been less really big bears observed, and the big bears aren't as fat (JS 2015).

*Distribution*

Overall, Inuvialuit knowledge indicates that polar bear den locations have changed over time and bear sightings near Tuktoyaktuk have increased. Despite these observed changes in distribution, Inuvialuit assert that there is no evidence to suggest that these changes have had an impact on abundance (JS 2015). Inuvialuit knowledge holder interviews in Slavik *et al.* (2009) suggested that as sea ice melts in the southern Beaufort Sea, polar bear distribution will shift northward.

*Climate Change*

Inuvialuit see and experience climate change firsthand, noting changes to temperature, freeze-up, break-up, ice conditions, wind and storm patterns; the book *Inuvialuit and Nanuq* (2015) explores Inuvialuit observations of climate change since the 1980s. Despite observations of the climate change and a nuanced understanding of polar bear ecology, Inuvialuit have not yet seen changes to polar bear abundance or condition (JS 2015). Inuvialuit consensus is that:

> "For the Inuvialuit, the future cannot be predicted; it could be good or bad as far as polar bears are concerned. However, the consensus among the workshop participants was that polar bears are highly intelligent animals that can adapt to climate change because they have been adapting to many things for thousands of years." (JS, 2015 p. 196)

**Scientific Knowledge**

*Abundance*

Scientific study of the SB polar bear subpopulation extends back to the 1970s. It is worth noting that scientific polar bear research is very expensive and takes place in remote, dangerous areas where weather patterns are highly unpredictable. These factors can significantly affect study success and the frequency of population inventories.

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

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

| Inventory period | Population Estimate | Confidence Intervals and Comments | Reference |
|---|---|---|---|
| 1972-83 | 1,778 | SD $\pm$ 803 CV=0.45 | Amstrup *et al.* 1986 |
| 1992 | Near 1,480 | | Amstrup 1995 |
| 1986-98 | 2,272 (2001) | Based on estimate of 1,250 females (C.V.=0.106); 55% females | Amstrup *et al.* 2001 |
| 2001-2006 | 1,526 | 95% CI=1211-1841; C.V.=0.106 | Regehr *et al.* 2007 |
| 2006 | 1,215 | Boundary change moves estimated 311 bears based on analysis in 2009. | Griswold *et al.* 2017 |

The current SB subpopulation estimate and estimate used for management is 1,215. This estimate is based on the Regehr et al. (2006) estimate (1,526) for the previous subpopulation area adjusted for new boundary at 133°W (Tuktoyaktuk) following a 2009 analysis by Griswold *et al.* (published in 2017), which indicated 311 bears would shift from the SB to the NB under the aforementioned boundary shift. This current SB subpopulation estimate cannot be compared with the historic estimates to assess trend. However, the Regher *et al.* (2006) population estimate of 1,526 bears can be compared to the previous (Amstrup *et al.* 2001) population estimate of 2,272; the more recent estimate is lower but the difference is not statistically significant.

*Trends in Abundance and Body Condition*

A recent population trend analysis by Bromaghin *et al.* (2015), suggests that a decline occurred in the SB polar bear abundance and body condition in the mid-2000s, coinciding with years of heavy sea ice conditions. The trend analysis suggests that abundance and body condition began to increase again towards the later 2000s. The study area and sampling regime on the Canadian side of the study area was inconsistent, which introduced bias into the analysis. It is difficult to assess the impact of this bias on the trend analysis. Further abundance and body condition trend analysis was completed for the Alaska side of the subpopulation (Atwood *et al.* 2020). This analysis found that abundance and body condition declined in the mid-2000s and then stabilized through to 2015.

*Future Abundance Work*

The Commissioners to the *Inuvialuit-Inupiat Polar Bear Management Agreement in the Southern Beaufort Sea* have recommended non-invasive population survey methods for the SB subpopulation. In 2017 an aerial survey method was tested, but failed to produce a robust population estimate. A genetic mark-recapture survey was designed instead, encompassing the SB and NB subpopulations. The first year of field work was 2019, with three to four years of fieldwork planned in total. The 2020 field season was postponed due to the Covid-19 pandemic.

Currently Inupiat and Inuvialuit have exclusive rights to harvest polar bears from the SB. The *Inuvialuit-Inupiat Polar Bear Management Agreement in the Southern Beaufort Sea* (signed 1988, revised 2011) sets out management principles including agreed upon harvest limits. These harvest quotas are mandatory in Canada. Since the signing of the agreement the quota has ranged from a maximum of 80 to the current quota of 56 with the new boundary. In recent years the entire quota is rarely taken (see Indigenous Knowledge, Harvest).

*Climate Change*

Scientific studies in the SB have noted sea ice declines (Durner *et al.* 2009), a reduction in body size and cub recruitment of SB bears in Alaska (Rode et al. 2010), and modeling that suggests declines in survival and breeding rates are related to increases in the ice-free period (Regehr *et al.* 2010).

**Harvest**

Hunting in the SB was historically largely conducted by non-Indigenous harvesters (Usher 1976). Quotas were first applied in Canada for the 1967-68 hunting season. In the absence of data, quotas for each settlement were established by averaging the harvest of the previous 3 years and then reducing that number by a modest amount (Brower *et al.* 2002). The first quota increases based on scientific information were made in 1978-79 after completion of the first population study of polar bears in the Western Arctic (Stirling et al. 1975). Quotas were based on the understanding that the total harvest of independent females would not exceed the modelled sustainable maximum of 1.5% of the population (Taylor et al. 1987) and that a 2:1 ratio of males to females would be maintained in the total quota harvested (Stirling 2002).Harvest of the SB subpopulation has been below the quota for several years. Changing sea ice conditions, and the length, distance needed to travel, difficult and cost of travel to access bears are all cited as reasons (Larry Carpenter pers. comm. 2020). Changing sea ice conditions has made it difficult for Inuvialuit to rely on established IK for planning harvest activities (JS, 2015).

**Protected areas**

All denning habitat along the Yukon coast is protected by Ivvavik National Park, Herschel Island Qikiqtaruk Territorial Park and the land withdrawal on the Eastern Yukon North Slope. In Alaska a large proportion of the coast is protected by 1002 lands in Arctic National Wildlife Refuge, however, recent changes in US law has potentially opened this area to oil and gas. The future of oil and gas development in the 1002 lands, which includes critical polar bear denning habitat for Southern Beaufort polar bears, is unclear as of February 2021. In Canada bears in dens are protected by Hunters and Trappers Committee by-laws and regulations. The Inuvialuit-Inupiat agreement also protects bears in dens.

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## Southern Hudson Bay (SH)

Boundaries of the Southern Hudson Bay polar bear subpopulation are based on observed movements of marked and collared bears (Jonkel *et al.* 1976; Kolenosky and Prevett 1983; Kolenosky *et al.* 1992; Obbard and Middel 2012; Middel 2013). The range of the SH subpopulation includes much of eastern and southern Hudson Bay and James Bay and large expanses of the coastline of Ontario and Québec as well as areas up to 120 km inland (Kolenosky and Prevett 1983; Obbard and Walton 2004; Obbard and Middel 2012). Inuit Knowledge has indicated that in Nunavik there were very few bears from the 1940s to the 1960s, with somewhat of an increase in the population from the 1960s to the 1980s, and a marked increase since the 1980s (NMRWB 2018).

The first population estimate for SH came from a three-year (1984–1986) mark-recapture study, conducted mainly along the coastline and inland areas of Ontario (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 area along and inland from the Hudson Bay coastline in Ontario and did not cover other jurisdictions, the area around James Bay, south of Hook Point or Akmiski Island. A subsequent 3-year capture-recapture study (2003–2005), covering this same area, produced an estimate of 681 bear (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 considered by the PBTC to be between 900-1000 bears for management purpose. Results from the two capture-recapture studies suggested that the abundance was unchanged between 1984–1986 and 2003–2005, though survival rates and body condition in all age and sex categories declined (Obbard 2008; Obbard *et al.* 2016). Inuit Knowledge from Nunavik, further north in the subpopulation's range, indicated a very high increase in observations of bears at this time, and no apparent declines in health (NMRWB 2018). A new aerial survey was conducted during the fall ice-free season over mainland Ontario (same geographic area as for the capture–recapture studies plus all areas along and Inland from the coast of James Bay) 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. Results of this mark-recapture distance-sampling (MRDS) analysis provided an estimate of 860 bears (95% CI: 580–1,274) on the mainland Ontario, neighboring islands, and Akimiski Island portions of the SH 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 SH (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 not substantially changed in abundance between the mid-1980s and 2012. Nevertheless, the duration of sea ice within the bounds of SH declined over this period (Hochheim and Barber 2014; Stern and Laidre 2016; NMRWB 2018) and scientific research also indicated a decline in body condition of bears during that same period (Obbard *et al.* 2016). Nunavik Inuit Knowledge indicated there may have been a population increase during this time and unchanging good health (NMRWB 2018).

An aerial survey, covering the same areas as the 2011/12 survey, was repeated in September 2016 to re-assess the abundance in SH. 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 (780 bears, 95% CI: 590–1029) suggested that the subpopulation had declined by approximately 17% 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 yearling (Obbard *et al*. 2018). Inuit knowledge from Nunavik indicated that the number of bears being sighted was among the highest it had been in a lifetime at the time of data collection in late 2014 and early 2015, although there were (sometimes very notable) fluctuations from year to year (NMRWB 2018).

To assess if the apparently low survival rate of cubs observed during the 2016 survey was an unusual event or represented an ongoing trend for SH, a partial survey of the Ontario coastline was conducted in September 2018. 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). 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.

The SH subpopulation range overlaps Nunavut, Québec and Ontario. A Total Allowable Harvest (TAH) of 25 bears is currently in place for Sanikiluaq which is the only community from Nunavut harvesting within SH. A Total Allowable Take (TAT) of 23 bears is in place in the Nunavik Marine Region, for the Inuit and Cree people from Québec, with a minimum of 1 bear allocated to the Cree. Part of the range occupied by the SH subpopulation (inland Québec, Ontario and part of the Eeyou Marine Region) however still currently remains without any applicable harvest limitation. An interjurisdictional process is underway for the entire SH subpopulation area to reassess the TAT/TAH for SH with regards to new scientific and IK information. As part of this process, a harvest risk assessment for SH was completed (Regehr *et al*. 2021) and suggests that this subpopulation has historically had a strong capacity for growth and was likely able to sustain harvest at relatively high rates (compared to other subpopulations). This assessment examined a range of possible scenarios for how polar bears in SH might respond to ongoing climate change and how this might influence the sustainability of harvest. Under what the authors considered to be a moderate level of influence of climate change on population growth, similar to what this subpopulation experienced over the last 15 years, the risk assessment indicated that the subpopulation could sustain a 3-4.5% harvest rate at a harvest sex ratio of 2 males to 1 female or a 2-3% harvest rate at a harvest sex ratio of 1 male to 1 female while still maintaining the population abundance above the maximum net productivity level. While the current total potential harvest (>48 bears) is above what would be considered sustainable under these conditions, reported harvest over the last decade falls within the bounds suggested by the risk assessment study. However, considering that harvest reporting is incomplete in Ontario and Québec, current estimates of harvest are likely biased low.  .In recent years, discussions with Indigenous communities around James Bay in Ontario and Quebec suggest that bears are being encountered and coming into conflict with people on the land and in communities more regularly. Reported defense of life and property kills during 2018-2019 and 2019-2020 in Ontario were also at their highest level since the 2007-2008 season.

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## Viscount Melville Sound (VM)

**Boundary**

The Viscount Melville Sound subpopulation (VM) extends from northern Victoria Island through the Viscount-Melville Sound to north of Melville Island, and from eastern M'Clure Strait, north to eastern Prince Patrick Island. The majority of the subpopulation area is within the Inuvialuit Settlement Region (ISR), with the eastern portion in Nunavut. A five-year study of movements and subpopulation size, using telemetry and mark-recapture, was completed for polar bears inhabiting VM in 1992 (Messier *et al.* 1992, 1994, Taylor *et al.* 2002). Population boundaries were based on observed movements of female polar bears with satellite radio-collars and movements of bears tagged in and out of the study area (Bethke *et al.* 1996, Taylor *et al.* 2001).

**Overview of co-management partners and management objectives**

The management partners and collaborating agencies for the VM subpopulation on the ISR side are the Government of the Northwest Territories, the WMAC (NWT), the Inuvialuit Game Council and Environment and Climate Change Canada. In Nunavut, Management partners include Government of Nunavut, Ekaluktutiak Hunters and Trappers Organization, Kitikmeot Regional Wildlife Board and the Nunavut Wildlife Management Board. Management objectives and guiding principles for the NB are outlined in the *Polar Bear Management Agreement for the North[ern] Beaufort Sea and Viscount Melville Sound Polar Bear Populations between Inuit of the Kitikmeot West Region in Nunavut and the Inuvialuit* (2006). The key objectives of this agreement are:

- To maintain the Northern Beaufort Sea and Viscount-Melville Sound polar bear populations at healthy viable levels in perpetuity, and

- To manage polar bears on a sustained yield basis in accordance with all the best information available

Under the *Species at Risk (NWT) Act,* polar bears are listed as a species of Special Concern. The *Inuvialuit Settlement Region Polar Bear Joint Management Plan* was published in 2017 for the species; the goal of this plan is to ensure the long-term persistence of healthy polar bears in the ISR while maintaining traditional Inuvialuit use.

**Indigenous Knowledge**

To date, a number of Indigenous knowledge (IK) studies have been completed that cover the ISR polar bear populations; the largest in scope and most recent is the 2015 book *Inuvialuit and Nanuq: A polar bear traditional knowledge study.* It is important to note, however, there can be significant IK presented orally during events like project consultation meetings or public hearings that is often not adequately captured in a way to use as reference material. *Inuvialuit and Nanuq* describes Inuvialuit knowledge:

> "The most important aspects of Indigenous knowledge concerning polar bears are the intergenerational knowledge (acquired from parents, grandparents and other elders) combined with direct experience. In general, this is what Inuvialuit mean by Traditional Knowledge (TK): personal knowledge acquired by travelling across ice, hunting seals and polar bears, running dog teams, reading wind directions, snow and cloud patterns, geographic features, currents and stars, and by intergenerational transmission." – JS 2015, p. 9

Inuvialuit note that "ice conditions, the effects of climate change and polar bear behaviour are extremely complex." (JS 2015, p. 197) Inuvialuit are reluctant to speculate about the future and long-term polar bear survival trends, given the high level of uncertainty in ecological conditions and how both bears and Inuvialuit will respond to these changes (JS 2015). Inuvialuit knowledge provides relative observations that can, in some cases, be used comparatively, to assess trends over time, or to draw a fuller picture of the VM polar bear subpopulation.

*Abundance*

During the verification workshop for *Inuvialuit and Nanuq* (JS 2015), consensus statements on changes to polar bear abundance over the lifetime of the TK holders were generated for each community:

- Ulukhaktok — "maybe a little change, but overall about the same. Polar bear movements are always different every year. To me it's the same, but a little bit change since when I was younger" (JS 2015, p. 184)

In 2009, polar bear abundance was considered to be high around Melville Island (Slavik *et al.* 2009) and in 2009-2013, Inuit knowledge indicated that this subpopulation was increasing, based on information provided at Canadian Wildlife Service Nunavut consultation meetings in 2009 (CWS unpublished) and community consultations in Cambridge Bay and Ulukhaktok during 2012 and 2013 (ENR unpublished meeting notes).

*Body Condition*

Inuvialuit knowledge holders in *Inuvialuit and Nanuq* (2015) agreed that polar bear body condition has remained generally stable over time, despite considerable variability within and between years. Inuvialuit also indicated that, since the 1980s, there have been less really big bears observed, and the big bears aren't as fat (JS 2015).

*Distribution*

Overall, Inuvialuit knowledge indicates that polar bear den locations have changed over time and timing of females with cubs entering and leaving dens has changed. Despite these observed changes in distribution, Inuvialuit assert that there is no evidence to suggest that these changes have had an impact on abundance (JS 2015).

*Climate Change*

Inuvialuit see and experience climate change firsthand and have a nuanced understanding of polar bear ecology. Inuvialuit have not yet seen climate-related changes to polar bear abundance or condition (JS 2015). Inuvialuit consensus is that:

> *"*For the Inuvialuit, the future cannot be predicted; it could be good or bad as far as polar bears are concerned. However, the consensus among the workshop participants was that polar bears are highly intelligent animals that can adapt to climate change because they have been adapting to many things for thousands of years." (JS 2015, p. 196).

**Scientific Knowledge**

*Abundance*

Scientific study of the VM subpopulation extends back to the 1970s. It is worth noting that polar bear scientific research is very expensive and takes place in remote, dangerous areas where weather patterns are highly unpredictable. These factors can significantly affect study success and the frequency of population inventories.

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

*Harvest*

Within Canada, quotas were first established in NWT by the 33rd Session of the Territorial Council at Resolute Bay. The quotas were to become effective on July 1 for the 1967-68 hunting season. In the absence of data, quotas for each settlement were established by averaging the harvest of the previous 3 years and then reducing that number by a modest amount (Brower *et al.* 2002).

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

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

Although the Melville quota was hunted most often by Sachs Harbour and Ulukhaktok, it was also allocated to hunters from Resolute and other areas in the eastern Arctic. In 1984, the Melville quota was permanently assigned to be shared between Sachs Harbour and Ulukhaktok.

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

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

In the negotiations for a management agreement for Viscount Melville Sound, the management area was adjusted and a quota of four was settled upon. Ulukhaktok was allocated a quota of four for Viscount Melville Sound in 1993-94. Beginning in the 1994-95 hunting season, a five-year moratorium on hunting polar bears in Viscount Melville Sound took effect because it was concluded that the population was overharvested. After that, a rotation took place between Cambridge Bay and Ulukhaktok, in alternate years, for a quota of four bears. Since Ulukhaktok had the last quota from Viscount Melville, the new rotation was scheduled to begin with Cambridge Bay in 1999-2000. Commencing in 2004/2005 the quota for Ulukhaktok and Cambridge Bay was set at four and three bears, respectively. That annual quota was thought to be less than the potential sustainable removal rate.

Harvest of the VM subpopulation has been below the quota for several years. Changing sea ice conditions, and the length, distance needed to travel, difficult and cost of travel to access bears are all cited as reasons (Larry Carpenter pers. comm. 2020). Changing sea ice conditions has made it difficult for Inuvialuit to rely on established IK for planning harvest activities (JS, 2015).

*Protected Areas*

There are currently no formal protected areas in the VM subpopulation but the area is very remote and limited human activities happen in the area. With decreased ice, shipping – especially that which includes ice breaking – is a potential conservation concern.

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## Western Hudson Bay (WH)

### Status and Delineation

Hudson Bay is a relatively shallow inland sea that is ice covered in winter and ice free in summer (Hochheim *et al*. 2010). Although three subpopulations of polar bears (Foxe Basin, Southern Hudson Bay, and Western Hudson Bay) occur on the sea ice in winter and spring, they appear to be largely segregated during the open-water season (Derocher and Stirling 1990; Peacock *et al*. 2010; Viengkone *et al*. 2016). During the ice-free period, Western Hudson Bay polar bears exhibit strong fidelity to terrestrial summering areas in northeastern Manitoba (Stirling *et al*. 1977; Derocher and Stirling 1990; Cherry *et al*. 2013; Stapleton *et al*. 2014; Lunn *et al*. 2016). The current Western Hudson Bay subpopulation boundary is based largely on capture, recapture, and harvest of tagged animals (Stirling *et al*. 1977; Derocher and Stirling 1990, 1995*a*; Taylor and Lee 1995; Lunn *et al*. 1997).

The size of the Western Hudson Bay subpopulation was unknown until the 1990s (Derocher and Stirling 1995*a*). During the 1960s and 70s, the numbers of polar bears likely increased as a consequence of the closure of the fur trading post at York Factory, withdrawal of military personnel from Churchill, and the closure of hunting in Manitoba (Stirling *et al*. 1977; Derocher and Stirling 1995*a*). Derocher and Stirling (1995*a*) estimated the mean population size for 1978-1992 to be 1,000 (SE = 51). However, this estimate was considered conservative because the study had not covered the southern portion of the range east of the Nelson River (Calvert *et al*. 1995; PBSG 1995) and, therefore, for management purposes the population size was adjusted to 1,200 (Calvert *et al*. 1998). In 1994 and 1995, Lunn *et al*. (1997) expanded the capture program to sample animals to the Western Hudson Bay/Southern Hudson Bay management boundary and estimated abundance to be 1,233 (SE = 209) in 1995. Regehr *et al*. (2007) reported a decline in abundance from 1,194 (95% CI = 1,020-1,368) in 1987 to 935 (95% CI = 794-1,076) in 2004 and also documented that the survival rates of cubs, sub-adults, and old bears (>20 years) were negatively correlated with the date of sea ice breakup.

A mark-recapture distance sampling study resulted in an abundance estimate of 1,030 (95% CI = 754-1,406) in 2011 (Stapleton *et al*. 2014). During this survey, 711 bears were observed and more bears, particularly adult males, were observed in the coastal areas east of the Nelson River towards the Western Hudson Bay/Southern Hudson Bay boundary than were documented during the late 1990s (Stirling *et al*. 2004). Stapleton *et al*. (2014) suggested that a distributional shift may have negatively biased abundance estimates derived from capture samples. Mean litter size (cubs-of-the-year, 1.43 ± 0.08; yearlings, 1.22 ± 0.10) and number of cubs observed as a proportion of total observations (cubs-of-the-year, 0.07; yearlings, 0.03) were lower than those recorded for the neighboring subpopulations of Foxe Basin and Southern Hudson Bay, which is consistent with Western Hudson Bay having low reproductive productivity (Regehr *et al*. 2007; Peacock *et al*. 2010; Stapleton *et al*. 2014). The body mass of solitary adult female polar bears has declined over the past 37 years, which has likely contributed to declining reproductive success (Derocher and Stirling 1995*b*; Stirling *et al*. 1999; Sciullo *et al*. 2016; Johnson *et al*. 2020; Lunn and McGeachy 2020).

Lunn *et al*. (2016) evaluated the demography and status of the Western Hudson Bay subpopulation for the period 1984-2011, using a Bayesian implementation of multistate capture-recapture models, coupled with a matrix-based demographic projection model, to integrate several types of data and to incorporate sampling uncertainty, and demographic and environmental stochasticity across the polar bear life cycle. Their analysis resulted in an estimate of 806 (95% CI = 653,984) for polar bears in the core area of study north of the Nelson River in 2011. Although both the aerial survey and capture-recapture estimates are broadly similar with overlapping confidence intervals, it is difficult to make direct comparisons because the geographical area covered differed. The aerial survey likely provides an accurate “snapshot” estimate of the total number and distribution of polar bears in the Western Hudson Bay management area at the time of the survey. The point estimate of abundance from the capture-recapture model represents the number of bears that move through the smaller, capture-recapture sampling area.

The most recent estimate of abundance comes from a mark-recapture distance sampling study in 2016 to update subpopulation status (Dyck *et al*. 2017). Pre-survey consultations with Nunavut Hunters’ and Trappers’ Organizations, Kivalliq communities, and with the Manitoba Department of Sustainable Development were conducted in order to use local and traditional knowledge in the study design. Dyck *et al*. (2017) reported the final estimate of abundance to be 842 bears (95% CI: 562–1121). Although not statistically significant from the previous aerial survey estimate, this difference represents an 18% decline in the point estimates of abundance from the 2011 and 2016 aerial surveys. Over the same period of time and using similar methods, Obbard *et al*. (2018) documented a 17% decline in abundance for the neighbouring Southern Hudson Bay subpopulation. Similar to observations from the 2011 survey, cubs-of-the-year and yearling cubs comprised a small proportion of the sample size (Dyck *et al*. 2017) and suggested that low reproductive performance of the Western Hudson Bay subpopulation has continued.

### Harvest Management

The management of the Western Hudson Bay subpopulation is the shared responsibility of the Governments of Manitoba and Nunavut, Parks Canada Agency, the Nunavut Wildlife Management Board, and the Wapusk Management Board. In Nunavut, WH polar bears are harvested under a quota system whereas there is no hunting of polar bears in Manitoba. The current total permissible removal is 42: Nunavut, 38; and, Manitoba, 4 (defense/accidental human-caused mortalities).

Beginning with the 2019/20 harvest season, Nunavut adopted a sex-based harvest ratio of up to 1 female for every male as part of its new Polar Bear Co-Management Plan. As the level of total permissible removals was not adjusted downwards to reflect the change from the previous 2:1 male-biased harvest, it is likely that the population growth rate will be reduced should an up to 1:1 harvest be realized.

### Protected Areas

Most of the known maternal denning area is protected within Wapusk National Park of Canada. Created in 1996, this 11,475 $km^2$ National Park is a remote wilderness area with no direct road access. Additional protection outside of the National Park is provided within the Churchill (8,500 $km^2$) and Kaskatamagan (5,500 $km^2$) Wildlife Management Areas designated under the Manitoba *Wildlife Act*. In February 2008, the polar bear in Manitoba was recognized as Threatened under the Manitoba *Endangered Species and Ecosystem Act*; which further ensures its protection, along with its habitat on both Crown and privately-owned land. The listing provides the ability to restrict development near critical habitat along the Hudson Bay coastline in Manitoba.

**Traditional Ecological Knowledge and Inuit Qaujimajatuqangit**

Inuit report that the size of the Western Hudson Bay subpopulation has increased when compared to historic levels (McDonald *et al*. 1997; Tyrrell 2006; Nirlungayuk and Lee 2009).

From the 1930s through the 1960s, encounters with polar bears in the interior of the Kivalliq mainland and along the Kivalliq coast of Hudson Bay were rare (Nirlungayuk and Lee 2009; Tyrrell 2009). Within the last few decades, encounters with polar bears in the Kivalliq region have increased. Bears have also been observed near and within WH communities (Arviat, Chesterfield Inlet, Rankin Inlet, Whale Cove), resulting in more bear-human encounters and increased concerns for human safety and property damage. Based on both historical and recent observations, the general observation is that the Western Hudson Bay subpopulation has increased (Tyrrell 2006, 2009; Canadian Wildlife Service 2009; Nirlungayuk and Lee 2009; Henri *et al*. 2010; Kotierk 2012).

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